n This Issue: Advances in Transmission Line Construction and New Power Development

JOURNAL OF ELECTRICITY

VOL. 40 NO. 6 SAN FRANCISCO, MARCH 15, 1918 PER COPY, 25 CENTS

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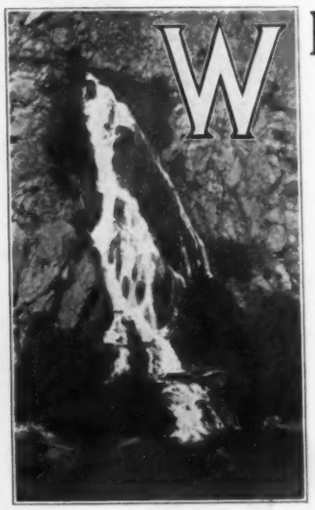

WEALTH unlimited is now released to national development in the final climax of a campaign waged by the Journal of Electricity—long and earnestly—for the upbuilding of the West. May this recent expression on the part of the chief executive soon unlock the vast power store houses of the West and thus conserve the fuel supply and add an industrial asset to the nation that neither time nor the destructive elements of nature can impair!

The White House, Washington,
19 February, 1918.

My Dear Mr. Secretary:

I have examined with care the memoranda and letters which you transmitted to me with your letter of the fifteenth. I fully share the views you express regarding the importance of the public service utilities as a part of our national equipment, especially in wartime. It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view. I hope that State and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation.

I shall be glad to have you communicate with the local authorities whenever the information in your possession suggests that such a course is desirable and in the national interests.

Cordially yours,
(Signed) WOODROW WILSON.

Hon. William G. McAdoo,
Secretary of the Treasury.

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JOURNAL OF ELECTRICITY

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VOLUME 40 — SAN FRANCISCO, MARCH 15, 1918 — NUMBER 6

Contents

RECENT ADVANCES IN TRANSMISSION CONSTRUCTION—*by L. M. Klauber* 272

A remarkable article setting forth the latest devices in transmission line construction as practiced in the San Diego-Capistrano tie-in line.

DOUBLE OVERHUNG FRANCIS TURBINES—*by Arnold Pfau* 279

The White Salmon River and Halsey plants—applications in the West of a comparatively recent development in large unit generators.

INTERCONNECTION AND WATER POWER DEVELOPMENT—*by P. M. Downing* 282

An authoritative discussion of the interconnection problem, setting forth the hindrances to present new power development that should be removed at once.

ADVANCES IN MULTIPLE ARCH DESIGN—*by L. R. Jorgensen* 286

Technical considerations involved in the design and construction of multiple arch dams are presented in this and later articles, by an authority on this type of construction.

WAR TIME PUBLIC UTILITY PROBLEMS—*by Max Thelen* 287

A terse statement of how the California Railroad Commission is aiding in new power development and in other war time activities.

HUMAN NATURE—*by H. A. Lemmon* 293

Most people are not catch riddles but simple problems of arithmetic—and the solution of how to make customers is a mere sum in selling psychology.

CUSTOMER'S COMMENTS 295

A woman customer tells why she didn't buy the electric heater she "shopped" for—a story with a moral which you may draw for yourself.

AN HOURLY SALE—*by W. R. Putnam* 296

A thoroughly successful special sale which was managed on a large scale without confusion—and a glimpse into how it was done.

CHANGES IN THE NATIONAL ELECTRICAL CODE—*by G. A. Cleary* 299

Advance information as to the changes which are to be made in the 1918 National Electrical Code briefly presented for the benefit of those making electrical installations.

EDITORIALS 269

Demand for Growth—The Super-Power Station—The Engineer and the Rebuilding of France—Old King Fuel Oil—An Electrification Difficulty Overcome—Helpful Factors in Fuel Conservation—The New Journal Service.

How the Upbuilding of the West is Helping to Win the War—IX—Frontispiece 268

Physical Data of the Highest Voltage System—by H. A. Barre 277

New Capistrano Substation—by H. W. Dennis 278

Some Reasons Why Power Development Has Ceased—by John A. Britton 284

Advances in Western Water Law—by A. E. Chandler 289

Prospective New Power Demands—by Gaskell S. Jacobs 289

Data Sheets for Fuel Oil Economy Tests—by Robert Sibley and Chas. S. Delany 290

Flood Lighting in Salt Lake City 294

Profit and Turnover—by F. B. Milligan 297

If I Were a Jobber—by M. L. Scobey 298

Installation of Cables for Interior Telephone Systems—by George A. Schneider 301

Notes on the Law of Patents—by Wm. K. White and H. G. Prost 303

Sparks 305

Personals 306

War Service Convention at Del Monte 308

Meeting Notices for Electrical Men 310

Builders of the West—XXV—O. B. Coldwell 310

Where Men of the West Meet 311

Happenings in the Industry 313

Latest in Everything Electrical 314

Aliens in American Industries 315

New Electrical Developments 316

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Index to Advertisers—page 16 Where to Buy in the West—pages 17-23

HOW THE UPBUILDING OF THE WEST IS HELPING TO WIN THE WAR—IX

HERE is the longest span of wire in the world—the crossing of Carquinez Straits in Central California by the great transmission lines of the Pacific Gas & Electric Company. A horizontal distance of 4427 ft. is covered in a single stretch of wire that has a clearance of 206 ft. above extreme high tide. Though originally constructed in 1901, the addition of two more wires since the opening of the European conflict has made this record-breaking link in the world's greatest high tension transmission system of even more effective aid in its service for the industrial and agricultural upbuilding of the nation. Such instances as this not only render timely assistance to the nation in its fight for the democracy of the world, but add a wealth to the West which will last throughout all posterity.

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JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 40 SAN FRANCISCO, MARCH 15, 1918 Number 6

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THE DEMAND FOR GROWTH in broadened vision is imperative in these days of national crisis. Are you in your quiet moments expanding your ideas of human endeavor? Are you a bigger, better, more efficient citizen—freer from the thraldom of hatred and jealousy—in these hours of trial by fire?

The subject of interconnection of power systems of the West finds an exact counterpart in recent discussion of the super-power station which has just been approved by the British ministry of reconstruction for supplying all the industries in Great Britain. It is proposed to supply these industries by means of not more than sixteen big super-power stations located in favored sections of the British Isles, and thus eliminate or combine all the smaller stations. The primary object is to economize in coal supplies together with the saving of by-products now wasted by the burning of coal in open grates and boiler furnaces. It is estimated that an annual saving of half a billion dollars in operating expenditure is possible.

The Super Power Station

The committee's proposals rest on the assumption that electricity is the most economical and convenient form in which to apply power to industry, and that the only way to generate electricity cheaply is to generate it on a very large scale. The report only anticipates what electrical specialists have foreseen for years as the natural electrical development in a country like Great Britain, which is small in area, closely settled, and rich in coal. In view of these conditions, Great Britain is regarded as the country in all the world best situated to profit most from such a national monopoly of power.

It is interesting to compare this situation with that existing in the Pacific Coast states of the Unied States of America. The giant transmission lines of this section of the world, properly interconnected, make available a continuous supply of electrical energy that feeds an empire several times that of the British Isles, and could quite effectively serve energy to many of the European countries considered collectively. Indeed, a single line—that of the Southern Sierras Power Company, stretching from Wonder, Nevada, to Yuma, Arizona, a distance of eight hundred thirty miles, is more than of sufficient length to supply electrical energy all the way from Paris to Berlin.

In consideration of the fact that distances and areas in the West are so vast in comparison with the industrial centers of Great Britain and Europe, the possible accomplishments of hydro-electric practice in the West show up even in a more fascinating and effective manner.

Charts recently compiled by the California Railroad Commission setting forth the normal increase in necessary power supply to meet the rapidly growing industrial and agricultural demands in north central California alone, indicate that as early as 1920, without further hydro-electric development being had, the total amount of fuel oil required for steam production of electric energy to supplement hydro-electric supply, would amount to 3,350,000 barrels annually, as against the use of approximately 1,000,000 barrels in 1916. When this ever increasing necessary production is projected to as comparatively an early date as 1922, the figures become almost appalling, and the necessity of taking immediate means to meet this demand in the West, by development of its hydro-electric resources of which there is a latent possibility of nine million horsepower in California alone, becomes imperative.

This is only one instance of the handwriting on the wall that super-hydro-electric power stations interconnected over the entire industrial and agricultural areas of the West, are even now a pressing demand.

In the present year of comparative light rain and snow precipitation, interconnection in some of the commonwealths of the West, notably California, will not perhaps bring about the great saving in power generation possible in normal years, as steam power supply will be of necessity largely used during the coming months. In normal years, however, the minimizing of steam generation and the interchange of storage and forebay facilities of the various power systems comprising the interconnected network will yield a very considerable return.

But the outstanding feature of the entire situation is that the recent utterances of President Wilson looking toward the unlocking of national water power resources for immediate development, for which principle the Journal of Electricity has striven so long and so earnestly, are timely, and evidence the fact that everything reasonably possible will be done at once to see to it that these shall be maintained at their maximum efficiency.

The Engineer and the Rebuilding of France

France, dearly beloved in the traditions of the American nation, has become so interwoven with the ideals and very life throbbing of the American Republic during recent months of trial, that it is questionable whether history has of record a more beautiful illustration of fraternal feeling among nations as instanced by these two great republics, the one in the Eastern and the other in the Western hemisphere.

It is questionable whether there exists a loyal American who does not each day in his yearnings toward France vow that in so far as his circumstances will permit, he will do all within his power to aid in her rehabilitation.

In the rebuilding of France the American engineer will undoubtedly contribute the leading part in technical skill, if not in outlay of actual money. At this period of the war, however, we can not and we must not divert material or physical effort that is so needed in bringing nearer the time when we may rebuild France, free from the possibilities of interruption or possible destruction of the philanthropic work American citizens feel for the great Republic of France.

It is well to remember that the slightest diverting of energies from the main issue—so long as that issue is still in the threatening attitude that it shows itself today—but weakens the cause of democracy in its struggle for the final liberation of all peoples and nations.

Old King Fuel Oil

From earliest childhood we have all been familiar with the nursery rhyme about "Old King Cole was a merry old soul." While King Coal is still holding tyrannical sway in Eastern centers, it appears that in spite of vast possibilities of undeveloped hydro-electric resources in the West, and in spite of the growing agitation for fuel substitutes, still "Old King Fuel Oil" will reign supreme in electric generation in the West for months to come.

A chart recently drawn by a member of the engineering staff of the California Railroad Commission, shown on another page of this issue, is most illuminating. This chart shows the total power demand in the states west of the Rockies. In order to fill in the area of energy demand indicated upon the chart, a curve is next drawn for that portion of electric generation possible by coal, then upon this area is superimposed the energy generation possible from present fuel oil production, and lastly is shown an area that must be met by increased hydro-electric development or else there must develop a most serious crippling of industrial and agricultural activity in the West. By reference to this chart the rather startling conclusion is seen that the present hydro-electric development must double in five and treble in eight years to meet the natural increase in demand.

Upon carefully viewing the outstanding features of the situation as thus presented, we cannot but view with increasing concern the possible outcome of such an impending situation. Even though all conditions of finance and restriction in development upon the national domain be removed, months upon months and even years must elapse before this new hydro power could be brought to the market places as electrical energy.

In view of this fact it becomes obvious to all that increased power economy in both steam and hydro units must be brought about. Inefficient blades, losses in entrance and exit, losses in chimney gases and losses in steam generation must be studied with greater analytical effort.

It is interesting to note in passing that many of the great central stations of the West have already gone at this matter of overhauling power plant economy with an enthusiasm that is producing marked results. The splendid system of steam power plant economy measuring apparatus at the Long Beach Plant of the Southern California Edison Company, and the excellent results obtained in looking into hydraulic units and studying how efficiencies may be bettered in a number of hydro-electric plants of the West, are forceful examples of what can be accomplished along these lines.

Only by such careful study can the reign of old "King Fuel Oil" be made peaceful and harmonious and a reign that will bring about the desired results in industrial activity that will enable the national government to effectively cope with the enemies of the cause of democracy.

An Electrification Difficulty Overcome

Electrification of railways is still a predominating point of discussion among electrical men the country over. The recent address of President Rice of the American Institute of Electrical Engineers at its midwinter convention is especially illuminating at this time.

On another page of this issue, P. M. Downing, operating manager for the vast system of interconnection of power systems recently brought about in north central California, alludes very forcefully to the ever-growing possibilities of electrification of railways.

One by one the hitherto apparently insurmountable difficulties standing out against electrification are disappearing. In the early stages of hydro-electric development, for instance, the shock that would be experienced in the generating system by having a sudden throwing on and off of a load of from five to six thousand kilowatts often proved serious.

The electrification of railroads in the West necessitates the handling of such fluctuating loads as this. The sinuous grades of the Tehachapi and the snow-sheds of the high Sierra introduce factors in the electrification idea that at times appear insurmouuntable stumbling blocks for future electrification, especially since only single track facilities prevail on these lines.

It is gratifying to note in passing, nevertheless, that this ability to handle such huge fluctuating loads due to recent advances in transmission characteristics, brings one step nearer the ultimate time when the electrification problem may be undertaken with earnestness and zest.

If a general scheme of electrification were decided upon, the natural procedure would be as pointed out by President Rice, to electrify those portions of the steam railroads which would yield the greatest results and give the greatest relief from existing congestion, and it is a growing conviction on the part of every thoughtful student of the subject that electrification offers the quickest, best and most efficient solution that is to be obtained.

Helpful Factors in Fuel Conservation

Steam power plant operators are finding in these days of fuel shortage that a close study of power plant economy is imperative. Hence a review of some of the helpful factors in fuel study and conservation that are available is most timely.

First and foremost must be mentioned the educative and helpful influence of the universities and technical colleges of the West, such as the University of Washington, Throop College of Technology, the University of California and Leland Stanford Junior University. These institutions are not only prepared to train technical fuel oil specialists, but the eminent scientists and engineers upon their teaching staffs are contributing noteworthy research data for the upbuilding of efficient mining and utilization of this important national resource.

The university extension idea is proving exceptionally helpful. Take for instance the work that has been inaugurated at the University of California, where service is now being rendered to over three hundred thousand people in the state of California. Practically every conceivable educative aid is available through this branch of university instruction. All operators or engineers interested in fuel oil, its uses and conservation, may for a small fee enjoy this excellent service. The only other requirement on the part of the applicant is that he be thoroughly in earnest in undertaking such study.

Another important branch of service in the conservation of coal, petroleum and other fuels is that instituted by President Woodrow Wilson, who has appointed Dr. H. A. Garfield as national fuel administrator. Mr. Garfield in turn has appointed Mark L. Requa as oil administrator. Mr. Requa is a mining engineer of note and much is expected of him in helping to solve the fuel situation. In the administration of his work the oil industry will be left in great measure to govern itself. Insistence, however, will be made upon the oil industry that it maintain fair and reasonable prices and that it co-operate to the fullest extent in supplying most efficiently the products of petroleum needed to meet the requirements of our army, navy and allies. Mr. Requa has appointed an able corps of assistants and much good is bound to result from his labors.

The various utility commissions throughout the West and the respective state councils of defense are contributing noteworthy effort in handling the fuel situation. The California Commission is doing excellent service in the handling of the petroleum situation. Authorized under the law to regulate the public utilities as to rates and other matters, this commission is now on its own initiative working out a scheme of interconnection of power companies in the state of California that will do much in conserving the fuel oil in that industry.

The recent report of the Committee on Petroleum for the California State Council of Defense contains an excellent series of conclusions and recommendations for fuel oil conservation.

Especial attention is called to the research investigations of the United States Bureau of Mines and the United States Bureau of Standards. Much helpful scientific data on fuel oil specifications and steam generation are to be gleaned from the various publications of the Bureau of Mines, while methods of standardization of thermometers and other measuring apparatus so necessary in these days of fuel economy are to be found in the helpful work of the Bureau of Standards. In discussions looking toward the production of petroleum the publications of the United States Geological Survey are timely, as are also the publications of the California State Mining Bureau.

The Book on Steam of the Babcock & Wilcox Boiler Works is perhaps the most helpful of its kind in existence in setting forth the elementary laws of steam engineering in a practical manner.

In regard to current aids in the technical press, the only paper in existence which devotes a regular department to the technical discussion of fuel oil and steam engineering is the Journal of Electricity, which is now in its thirty-first year of publication and is the recognized authority on this line of discussion.

The work of the Pacific Coast Section, N. E. L. A., along lines of fuel oil economy in steam power generation has proven most helpful. Through this means of expression the great power companies of the West which use oil as a fuel are contributing noteworthy aids to efficient uses of this product.

The American Society of Mechanical Engineers and the American Institute of Electrical Engineers constitute the two great national societies of professional status that are exceedingly helpful in fuel oil study.

THE NEW JOURNAL SERVICE: Due to an ever-increasing demand on the part of its readers and advertisers, the Journal of Electricity has instituted another most helpful branch of its activities, to be known as "Advertising Service." Readers of the Journal of Electricity desirous of getting notice of what is to appear in coming issues will always find in this place on the editorial page a terse statement of some of the leading features to be brought out in future discussions. As a forceful illustration of this service we herewith publish a miniature reproduction of our current mailing card to advertisers, setting forth the features of the convention issue of the Journal of Electricity, April 1, 1918. Incidentally, this card gives information of coming articles that deal in matters of great timely interest to users of electrical energy in the West.

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Advertising Service

Our issue of April 1st will feature the convention papers of the Pacific Coast Section N. E. L. A., covering:

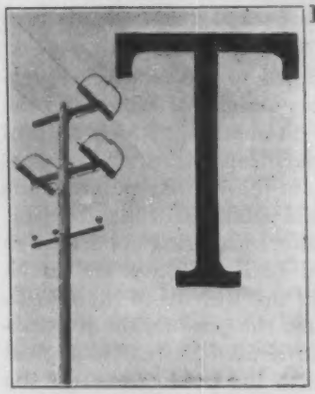
1. Increasing Business on Existing Lines
2. Practical Selling Methods
3. Industrial Electric Heating
4. Interconnection of Hydroelectric Lines
5. Practical Means for Increasing Efficiency of Existing Lines

JOURNAL OF ELECTRICITY

RECENT ADVANCES IN TRANSMISSION CONSTRUCTION

BY L. M. KLAUBER

(Poles, insulators, wire arrangement, questions of overhead crossings, and construction problems of high-tension transmission line work have been brought to the fore by the recent discussion of interconnections of power lines throughout the West. Details of the latest advances in design for apparatus of this nature are here given in a graphic and interesting way as they have been used in the San Diego tie-in line which forms the connecting link in the system which will reach from near Fresno down across the desert to the Mexican border. The author is superintendent of construction with the San Diego Consolidated Gas & Electric Company, and has himself been responsible for many of the recent advances in transmission line construction.—The Editor.)

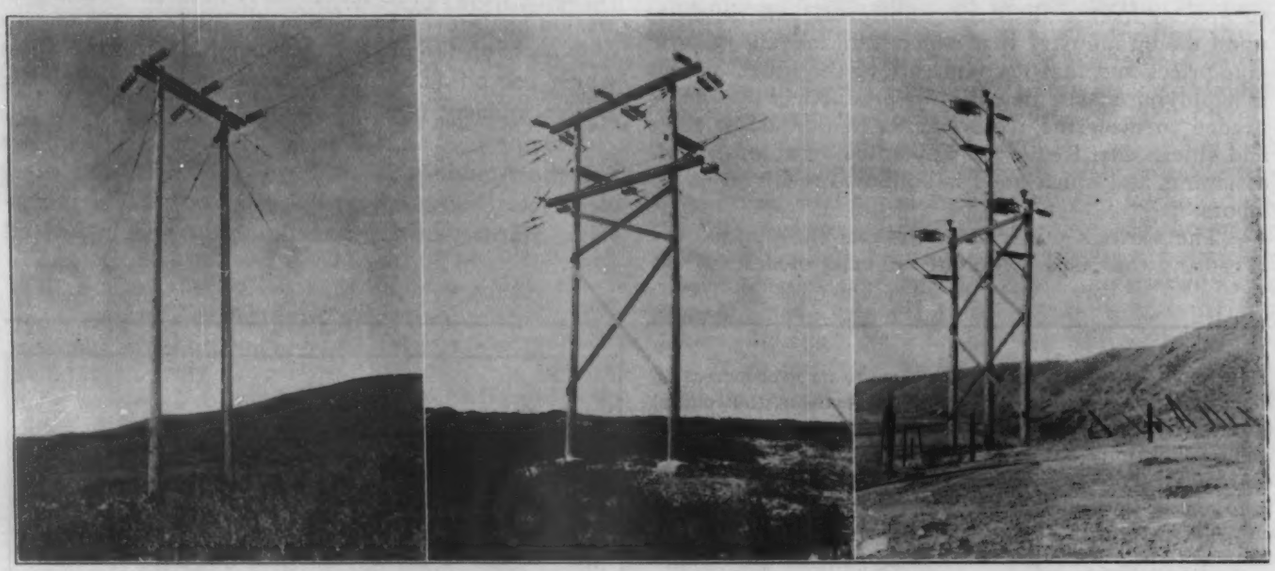


The line switches used are of the K-P-F type, rated at 88,000 volts. Note the mounting on the pole.

THE San Diego Consolidated Gas & Electric Company has recently completed a 78½-mile 66 kv. transmission line from San Diego to San Juan Capistrano, in Orange county, to tie the system of the San Diego company to that of the Southern California Edison Company at the latter point. Arrangements were consummated for the purchase of energy from the Edison Company in the spring of 1917, and work was begun on the transmission line as soon as the necessary material could be accumulated. The decision to purchase energy from the Edison Company was made primarily as an oil-saving measure, and when the terminal substations have been completed, a saving of 140,000 barrels of oil per year will be effected.

The Southern California Edison Company generates at 50 cycles, while the San Diego Consolidated Gas & Electric Company operates at 60 cycles. Frequency changers are, therefore, necessary for interconnecting the two systems. The frequency changer substation will be located at San Juan Capistrano, and will be installed and operated by the Southern California Edison Company. This station is described on another page of this issue. The San Diego substation will be located in a portion of the steam plant at Tenth street and Imperial avenue, formerly given over to reciprocating units now removed. The transformer installation will consist of four 2000 kva. Westinghouse O. I. W. C., 66/11 kv. transformers, one being a spare. These are of the outdoor type, but will be mounted within the building.

The transformer bank will be connected star-delta, the neutral on the high tension side being grounded at both ends of the line. Transformers will be mounted on rails adjacent to a pit installed for expediting the removal from the case of the coils of any unit which may require inspection or repair. On the 66 kv. side air break switches only are provided. On the 11 kv. side a new bus system is being installed complete with General Electric K-22 and K-24 oil switches. These switches will control the 11 kv. side of the step-down transformer bank, the four out-going 11 kv. feeders and two transformer banks of 3000 and 1500 kilowatts capacity, respectively, stepping down from 11 kv. to 2300 volts. The main distribution from this station



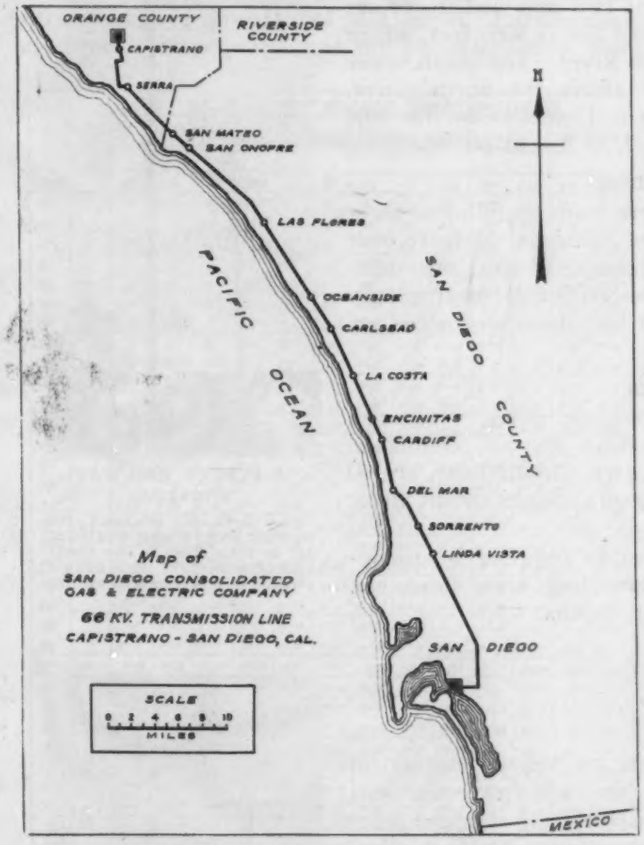
TOWER CONSTRUCTION FOR SPANS OF 600 FEET AND OVER

This is the lightest form of 2-pole tower construction for spans of from 600 to 1000 ft. (Type T). The conductors are in a horizontal plane with a separation of 6 ft. 6 in.

A 2-pole tower construction with cross bracing for spans of 1000 to 2500 ft. where adjoining spans are shorter than 1000 ft. The conductors have an 11-ft. separation. The same type of tower with minor changes is used where adjacent spans are longer. Note the concrete base for the poles set in marsh.

For spans of from 2500 to 3500 ft., where adjoining spans are shorter than 1000 ft., this 3-pole tower is used (Type S). The conductor arrangement is an equilateral triangle with a separation of 20 ft.

is at 2300 volts for use in the central district of San Diego, there being fourteen single-phase and seven 3-phase 2300 volt feeders. All of the 2300 volt and 11 kv. switches are electrically operated remote control. General Electric aluminum lightning arresters are being provided for the in-coming line; these will be located on the roof of the power plant. Out-going 11 kv. feeders will be equipped with General Electric low equivalent multigap arresters.



MAP OF THE CAPISTRANO-SAN DIEGO LINE

This line completes the interconnection of power lines in Southern California, which now stretch from Big Creek 400 miles down across the desert as far as Mexico.

The San Diego steam plant has a capacity of 14,600 kva., and this together with the transmission line having a maximum capacity of 10,000 kva., will be sufficient to serve the San Diego community for some time. For the present the steam plant will be operated mainly as a reserve. It is probable that one turbine will be kept floating on the line, primarily for voltage regulation.

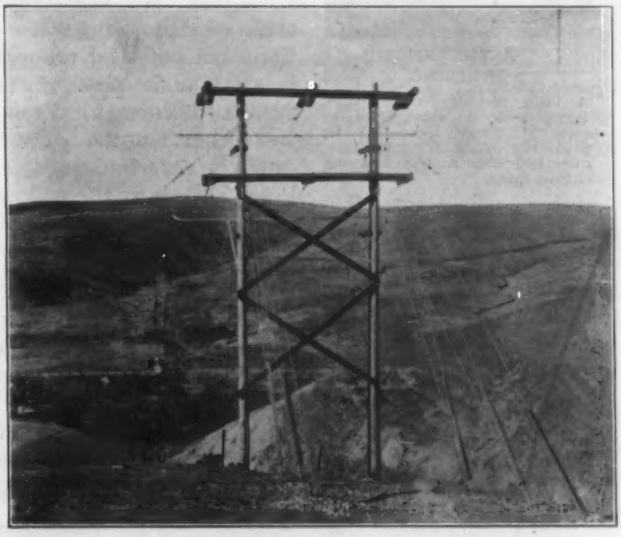
In addition to the San Diego substation the transmission line will be tapped at Oceanside and at Del Mar. At the first point two 300 kva. 3-phase 66 to 11 kv. O. I. S. C. outdoor type Westinghouse transformers will be installed, and at the latter point one of the same size. Aluminum lightning arresters will be installed at each point. Transformers will not be protected with overload devices on the primary side, but on the secondary side General Electric K-12 switches are provided. Each substation will feed the local distribution in that district; the Oceanside substation feeding as far east as Escondido and San Pasqual, and as far north as Fallbrook and Las Flores.

The transmission line is of wood pole construction throughout. That portion of the line between Del Mar and Oceanside was built during 1916, and has been temporarily operated at 11 kv. since January, 1917. The balance of the line has been built during the past year, having been completed early in February, 1918, and is now being operated at 11 kv., pending the receipt of substation apparatus by the Edison and San Diego companies.

A summary of the specifications of the transmission line is as follows:

Conductors

Except for the original portion of the line between Oceanside and Del Mar, where No. 2 solid copper was used, the line is built of No. 1, 7-strand, medium hard drawn, bare copper. All wire was tested by one of the commercial testing laboratories at the Eastern factories before shipment. On some of the long spans, steel conductors were used, especially on spans exceeding 1100 feet, of which there are 14. The steel ordinarily used is 7/16 inch, 7-strand extra galvanized special high strength (18,000 lbs.) quality, but on the longest span 7/16 in. extra galvanized extra high strength (22,500 lb.) steel is employed.



GUYING SYSTEM FOR TYPE S, 2-POLE TOWER

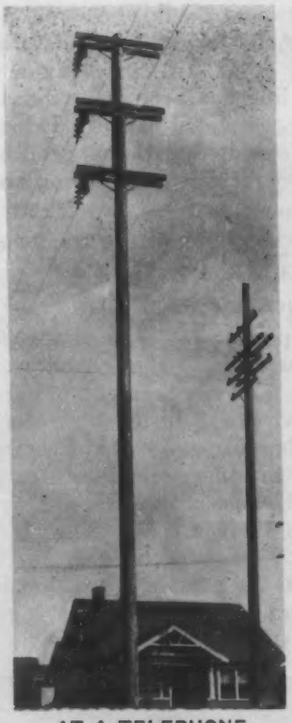
A span of 3069 ft., across Mission Valley river. The complete anchor system is shown. For long span towers on the back guys, the cable is of the same quality as the steel used as a conductor—elsewhere ⅜-in. extra galvanized steel is used. White No. 506 strain insulators are used in all guys to comply with the state law. However, as this insulator is admittedly electrically inadequate to the line voltage, the pole end of every guy is grounded. Pyramidal concrete anchors are employed except in marshy ground, where large treated wood slugs are installed. Anchor rods were ¾-in. galvanized, 8 ft. long. Anchor boxes were employed where required for protection of persons.

Stringing Conductors

Copper conductors were sagged in accordance with the table shown. Foremen were given instructions never to string at less than these sags, although they were given permission to exceed the sags where required by special considerations, and where clearances were not unduly decreased. All long spans where steel is employed were sagged with a dynamometer.

Splices

Line wire splices in tension are made with Hickey & Schneider seamless copper splicing sleeves. Where splices are made on deadend poles between horizontal



AT A TELEPHONE CROSSING

A twin circuit construction (type 2-66 R) designed for straight away lines. It is primarily used at crossings over railroads and communication lines.

strings of insulators, ordinarily three-bolt guy clamps are used, with several turns around the neck on each side of the clamp.

Spans

Spans are 440 feet on tangents in level country. Longer or shorter spans are employed, as dictated by topography. Spans are made shorter where passing through towns and on that portion of the line which is of twin circuit type. The maximum single po'e span is 600 feet. On longer spans two pole structures are used. The longest span in the line is 3069 feet, where the line crosses the San Diego River. The south tower is at an elevation 100 feet above the north tower. The lowest point in the sag is 17 feet below the low tower. The wire tension is 8750 lbs. at 60° F.

Clearances

Minimum clearances were made as follows: Over rails of railroads or street railways, 34 feet; over streets, alleys or public highways, 30 feet; over telephone, telegraph or signal wires, 8 feet; over supply lines, 8 feet. As a matter of fact these clearances are ordinarily greatly exceeded.

Poles

Class "A" Western red cedar poles, with open tank treated butts were used as far as obtainable. Standard poles on tangents, twin circuit lines, are 60 feet; standard poles on tangents, single circuit lines, 50 feet; at corners, 55 feet.

Other lengths were used as required by topography, trees, buildings, intersecting wire lines, etc. Poles are set at the following depths:

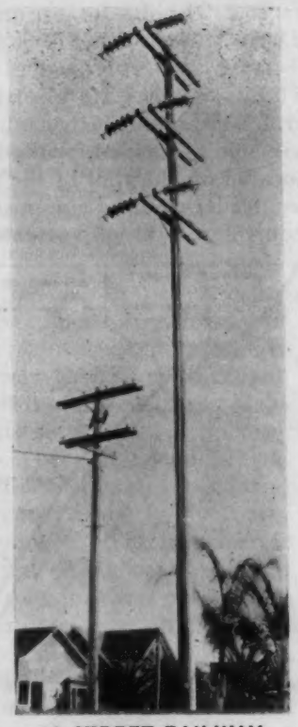
50 feet	7 feet
55 "	7½ "
60 "	7½ "
65 "	8 "
70 "	8 "
75 "	8½ "

Poles are set in concrete on heavy corners in marshes; otherwise where the line traverses soft ground redwood mud sills are installed. Trussed poles set in concrete, or push braces are used where it is impossible to secure anchor rights.

On a portion of the line a sufficient supply of Western red cedar poles could not be obtained, and a number of Douglas fir poles were consequently installed. These make fine, strong, straight poles, but have certain objections, viz: after drying they are hard and consequently difficult to climb, and while weathering they tend to spiral slightly, thus twisting the crossarms and necessitating straightening the line. Also the taper ordinarily averages about 1 inch in 15 feet or more, rather than 1 inch in 10 feet, as is the case with cedar, and therefore poles with larger tops are required for equal butts as compared with cedar. As to the lasting qualities of Douglas fir with open tank treated butts, under the particular conditions obtaining on this line, time alone will tell. Owing to the hardness of the wood, the penetration of the wood preservative is not as deep as with cedar.

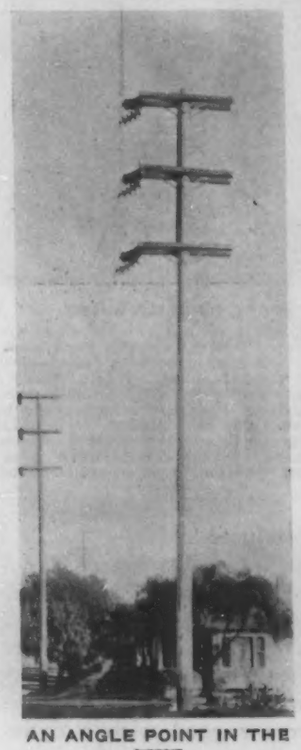
Wire Arrangement

To aid in the proper issuance and simplification of orders and discussion of line construction, it was early decided to assign type letters to the various styles of crossarm arrangements used. In general, on the twin circuit portion of the line, three horizontal



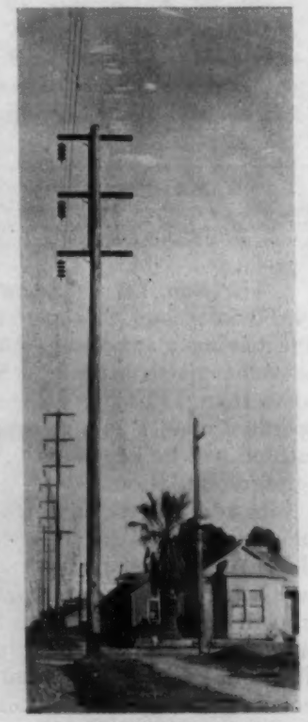
A STREET RAILWAY CROSSING

Type 2-66 X, is used for leading and turning angles of 15° to 174°. This is the dead-end construction with double strings of insulators in strain.



AN ANGLE POINT IN THE LINE

The same type as shown above (2-66 R) is used for angles between 170° and 180°. It is distinguished in each case by double strings of suspension insulators in suspension at an angle.



A STRAIGHT AWAY STANDARD TYPE

This is the standard twin circuit construction for city streets (type 2-66 W), used for straight away lines and angles between 174° and 180°. It is the ordinary type on tangents.

crossarms are used, the wires of each circuit occupying a vertical plane. The single circuit portion is constructed mainly with a triangular arrangement of the well-known Byllesby wishbone type. This is believed to be the most economical single circuit construction, for by its use the top wire of the triangle is raised to the level of the pole top, whereas if the crossarms were horizontal this wire would fall three feet below. Thus, under equal clearance conditions, this type of construction saves three feet of pole height. Furthermore, no braces are required, yet the construction is more

TABLE OF SAGS FOR VARIOUS TEMPERATURES

REINFD STRANDED BARE COPPER CONDUCTOR

TEMP	SPAN	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	200'	210'	220'
40°		12"	13"	14"	15"	16"	18"	19"	20"	22"	23"	24"	2'-1"	2'-3"
45°		13"	14"	15"	16"	17"	19"	20"	21"	23"	24"	2'-1"	2'-2"	2'-4"
50°		14"	15"	16"	17"	18"	20"	21"	22"	24"	2'-1"	2'-2"	2'-3"	2'-5"
55°		14"	15"	16"	17"	18"	20"	21"	22"	24"	2'-1"	2'-2"	2'-3"	2'-5"
60°		15"	16"	17"	18"	19"	21"	22"	23"	2'-1"	2'-2"	2'-4"	2'-5"	2'-7"
65°	SAGS	16"	17"	18"	19"	20"	22"	23"	24"	2'-2"	2'-3"	2'-5"	2'-6"	2'-8"
70°		16"	17"	18"	19"	21"	23"	24"	2'-1"	2'-3"	2'-4"	2'-6"	2'-7"	2'-9"
75°		17"	18"	19"	20"	22"	24"	2'-1"	2'-2"	2'-4"	2'-5"	2'-7"	2'-8"	2'-10"
80°		18"	19"	20"	21"	22"	2'-1"	2'-2"	2'-3"	2'-5"	2'-6"	2'-8"	2'-9"	2'-11"
85°		18"	19"	20"	21"	23"	2'-2"	2'-3"	2'-4"	2'-6"	2'-7"	2'-9"	2'-10"	3'-0"
90°		19"	20"	21"	22"	24"	2'-2"	2'-3"	2'-5"	2'-7"	2'-8"	2'-10"	2'-11"	3'-1"
TEMP	SPAN	230'	240'	250'	260'	270'	280'	290'	300'	310'	320'	330'	340'	350'
40°		2'-6"	2'-6"	2'-8"	2'-10"	3'-0"	3'-2"	3'-4"	3'-7"	3'-9"	3'-10"	4'-2"	4'-6"	4'-10"
45°		2'-5"	2'-7"	2'-9"	2'-11"	3'-1"	3'-3"	3'-5"	3'-9"	3'-10"	3'-11"	4'-3"	4'-7"	5'-0"
50°		2'-6"	2'-8"	2'-10"	3'-0"	3'-2"	3'-4"	3'-6"	3'-10"	4'-0"	4'-1"	4'-5"	4'-9"	5'-1"
55°		2'-6"	2'-8"	2'-11"	3'-1"	3'-3"	3'-5"	3'-7"	3'-11"	4'-1"	4'-2"	4'-6"	4'-10"	5'-3"
60°	SAGS	2'-8"	2'-10"	3'-0"	3'-2"	3'-4"	3'-6"	3'-8"	4'-0"	4'-2"	4'-3"	4'-7"	4'-11"	5'-4"
65°		2'-9"	2'-11"	3'-1"	3'-3"	3'-5"	3'-7"	3'-9"	4'-1"	4'-3"	4'-4"	4'-8"	5'-0"	5'-5"
70°		2'-10"	3'-0"	3'-2"	3'-4"	3'-6"	3'-8"	3'-10"	4'-3"	4'-5"	4'-6"	4'-10"	5'-2"	5'-7"
75°		2'-11"	3'-1"	3'-3"	3'-6"	3'-8"	3'-10"	4'-0"	4'-4"	4'-6"	4'-7"	4'-11"	5'-4"	5'-9"
80°		3'-1"	3'-3"	3'-5"	3'-7"	3'-9"	3'-9"	4'-1"	4'-5"	4'-8"	4'-9"	5'-1"	5'-5"	5'-10"
85°		3'-2"	3'-4"	3'-6"	3'-8"	3'-10"	4'-0"	4'-2"	4'-6"	4'-9"	4'-10"	5'-2"	5'-6"	5'-11"
90°		3'-3"	3'-5"	3'-7"	3'-9"	3'-11"	4'-1"	4'-3"	4'-8"	4'-10"	4'-11"	5'-4"	5'-8"	6'-1"
TEMP	SPAN	375'	400'	425'	450'	458'	475'	500'	525'	550'	575'	600'	650'	700'
40°		5'-5"	6'-2"	7'-0"	7'-7"	8'-0"	9'-0"	10'-2"	11'-5"	12'-8"	14'-1"	15'-7"	18'-1"	22'-3"
45°		5'-7"	6'-5"	7'-2"	7'-9"	8'-2"	9'-2"	10'-4"	11'-7"	12'-10"	14'-3"	15'-9"	18'-3"	22'-5"
50°		5'-8"	6'-5"	7'-4"	7'-10"	8'-3"	9'-3"	10'-6"	11'-9"	13'-0"	14'-5"	15'-11"	18'-5"	22'-7"
55°		5'-10"	6'-7"	7'-6"	8'-0"	8'-5"	9'-5"	10'-8"	11'-11"	13'-2"	14'-7"	16'-1"	18'-7"	22'-9"
60°	SAGS	5'-11"	6'-8"	7'-7"	8'-2"	8'-7"	9'-7"	10'-10"	12'-1"	13'-4"	14'-9"	16'-3"	18'-9"	22'-11"
65°		6'-1"	6'-10"	7'-9"	8'-4"	8'-9"	9'-9"	11'-0"	12'-3"	13'-6"	14'-11"	16'-5"	18'-11"	23'-1"
70°		6'-2"	6'-11"	7'-10"	8'-6"	8'-11"	9'-11"	11'-2"	12'-5"	13'-8"	15'-1"	16'-7"	19'-1"	23'-3"
75°		6'-4"	7'-1"	8'-0"	8'-7"	9'-0"	10'-1"	11'-4"	12'-7"	13'-10"	15'-3"	16'-9"	19'-3"	23'-5"
80°		6'-5"	7'-3"	8'-2"	8'-9"	9'-2"	10'-3"	11'-6"	12'-9"	14'-0"	15'-5"	16'-11"	19'-5"	23'-7"
85°		6'-7"	7'-4"	8'-4"	8'-11"	9'-4"	10'-5"	11'-8"	12'-11"	14'-2"	15'-7"	17'-1"	19'-7"	23'-9"
90°		6'-8"	7'-6"	8'-6"	9'-1"	9'-6"	10'-7"	11'-10"	13'-1"	14'-4"	15'-9"	17'-3"	19'-9"	23'-11"

SAG TABLE USED FOR STRINGING CONDUCTORS
The sags may be exceeded under special circumstances, but it is not permissible to lessen them

rigid than that secured with parallel arms and braces, and this at the expense of only 2 feet 8 inches of additional crossarm length, the diagonal arm being 10 feet 8 inches in length, whereas the horizontal arm is 8 feet.

Crossarms

Crossarms are of clear, straight-grained Douglas fir, painted with two coats of yellow cement paint. A variety of sizes were used with the various types of construction above described. Crossarms on W and X construction have a cross section 3¼ inch by 5¼ inch. On U and V construction they are 9¼ inch by 9¼ inch.

Braces

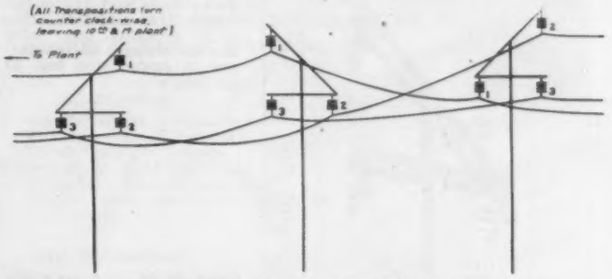
Braces were not ordinarily required with the type of construction used. In the twin circuit construction, angle iron braces are installed.

Insulators

Locke insulators, No. 3538, are used as a standard. Four constitute a string in vertical suspension, and 5 when used horizontally in strain. In single pole work and two-pole towers of the "T" type, single strings are used. In "U" and "V" construction parallel strings are employed, properly spaced and balanced by means of steel yokes; and in "S" construction there are 4 strings in parallel.

Attachment of Insulators

Insulators in suspension are attached to crossarms by means of "J" bolts and "C" hooks, a method which gives full flexibility at point of suspension in all direc-

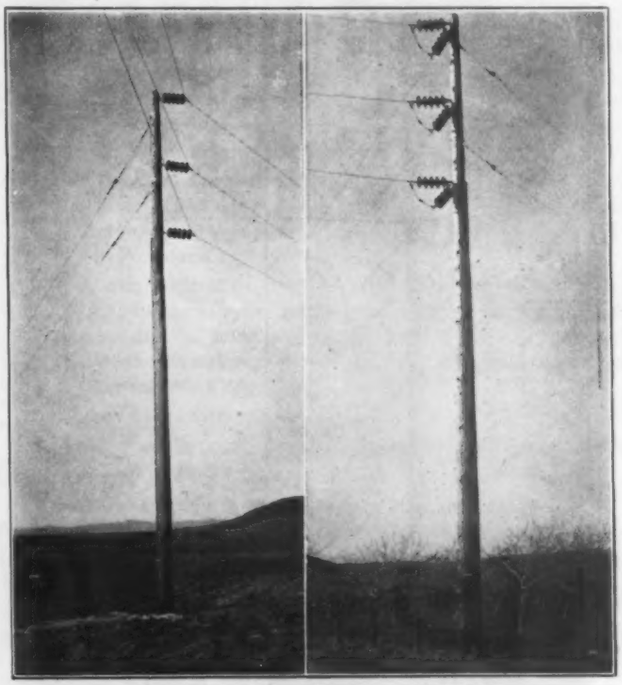


THE STANDARD TRANSPOSITION
Sixteen mile barrels are the rule. Transpositions are effected in single circuit construction by merely reversing one pole top. The turn is counter clockwise.

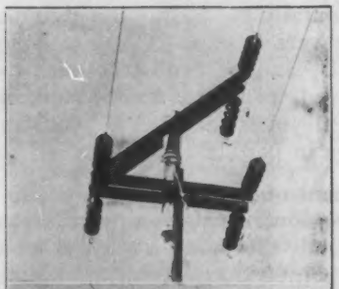
tions, and seems to obviate any tendency of the conductor to break close to the clamp. No. 4333 Locke suspension clamps are used; these are likewise of a flexible type. Horizontal strings of insulators are attached to poles or crossarms by means of universal deadend clevises, Hubbard No. 555.

Ground Guards

In accordance with the desires of the Railroad Commission, special angle iron ground guards were installed at all spans exceeding 1000 feet which cross over railroads, telephones or main traveled highways.

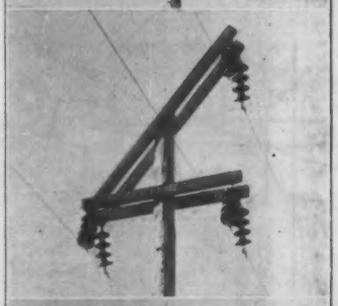


FOR TURNING CORNERS—TYPES Z AND Y
Vertical corner poles without crossarms. The Z pole on the left with single strings of insulators is designed for turning angles of 110° to 165° and 0° to 70°. The Y type at the right with double insulators is for angles of 70° to 110° and is primarily used at right angle turns.

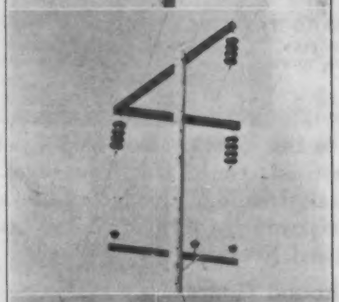


SINGLE CIRCUIT CONSTRUCTION

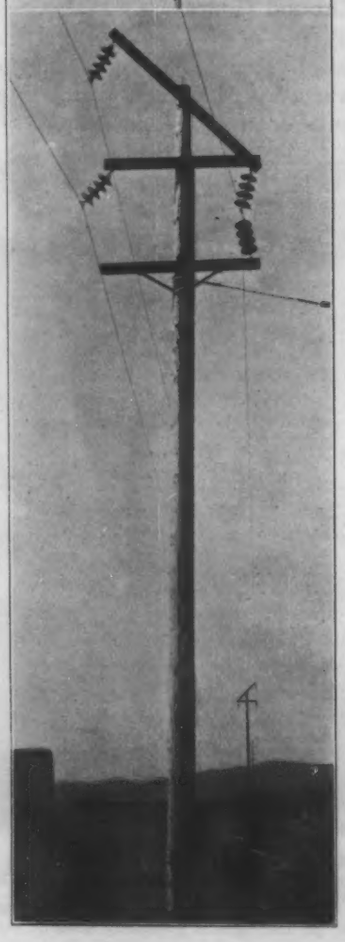
Type 66 X, a typical deadend pole of the single circuit type with insulators in strain for deadending and turning angles of 150° to 174°.



Type 66 R — for straight away lines and angles between 174° and 180°. This is a crossing pole with double strings of insulators in suspension but at an angle.



Type 66 W—for tangents and angles between 174° and 180°. This is a single arm wishbone type pole used on tangents and constitutes the great bulk on construction on this line.



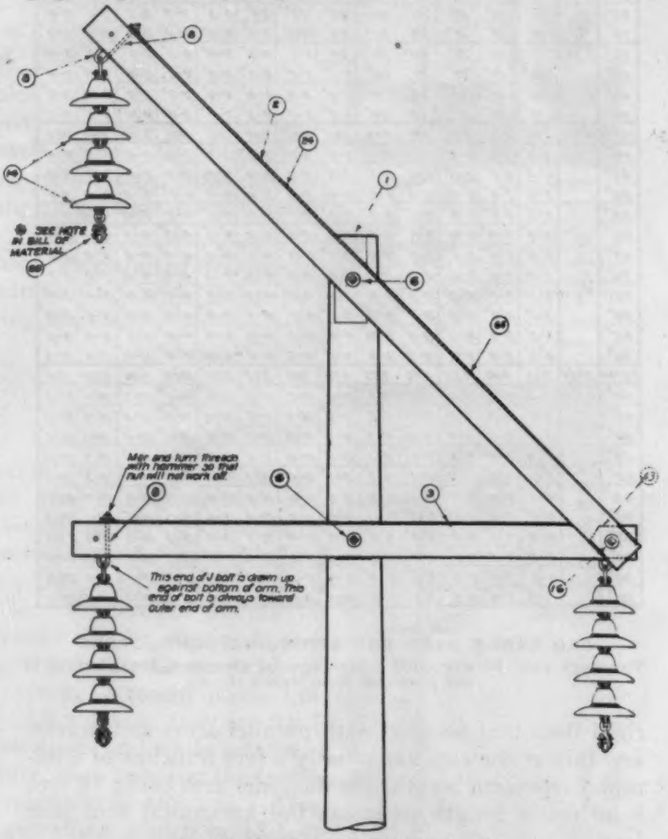
Type 66 Q—for turning angles between 165° and 175°. This is a "W" pole with a special holding down arm to keep the string which would tend to turn in toward the pole from swinging.

Grounding

As noted above, all poles to which guys are attached, are grounded. Poles having no guys have the pole ends of all insulator strings electrically connected together by means of a ¼ inch steel cable. On the twin circuit construction it is proposed to ground this interconnecting cable at the time the second circuit is installed. All vertical runs of grounding cable are covered with redwood moulding.

Deadend Clamps

Ohio brass No. 10755 strain clamps are installed at all deadend points where copper conductors are used. At long spans with steel conductors, some special patented clamps were employed, but these were later abandoned in favor of a simple pulley wheel, in order to give a large bending radius for the stiff steel cables used. A wheel of this type is more difficult to install than a deadend clamp, but once installed slippage is practically impossible.


SEE NOTE IN BILL OF MATERIAL
Mar and burn threads with hammer so that nut will not work off.
This end of J bolt is drawn up against bottom of arm. The end of bolt is always toward outer end of arm.

PLAN DRAWING OF CROSSARM

The details of construction are here clearly shown. This is type W shown across the page. As the prevailing winds in this section are from the west, two of the three wires along the main line are placed on the east side of the pole.

A study of the illustrations will show not only the methods of stringing insulators, but also the relative height and tapering of poles, method of guying and the like. Note the clearances over railroad crossings and telephone lines as indicated, and the varying type of cross arms. The base construction where shown is worthy of note, particularly the concrete foundation for marshy ground, illustrated in the case of the medium span tower construction. Further information on the frequency changer substation operating between this tie-in line and that of the Southern California Edison Company will be found on page 278.

PHYSICAL DATA OF THE HIGHEST VOLTAGE SYSTEM

BY H. A. BARRE

(Terse data concerning the giant Big Creek hydro-electric development and transmission system of the Southern California Edison Company—now the most striking system of high voltage transmission in existence—will be found of great timely interest in these days of interconnection and thoughtful study in hydro-electric conservation. The author is electrical and mechanical engineer for this company and one of the most distinguished engineers of the West in matters of high tension design.—The Editor.)

Equipment Data

Two power plants, total capacity 64,000 kw.

Four 17,500 kva. generators.

Eight tangential water wheels; each pair develops 16,000 kw.

One generator, full load, 24 hours, uses 240 acre feet of water.

Maximum head of water: Plant No. 1, 2100 ft. static. Plant No. 2, 1900 ft.

Reservoir capacity, 88,000 acre feet. Cubic yards concrete in dams, 250,000.

Drainage area, 79 square miles.

Five miles of 12 ft. tunnels through solid rock.

Single phase transformers, largest yet built, weigh 81 tons and contain 10,000 gals. of oil.

Power station transformers connected delta 6600 volts, Y 150,000 volts, with grounded neutral.

Receiving station transformers connected delta 150,000 volts, delta 60,000 volts and 18,000 volts respectively.

Two 15,000 kva. synchronous condensers at receiver end each require 10,000 kva. to start.

Under no load conditions, 137,000 volts at generator rises to 150,000 volts at receiver.

Charging current is 90 amperes at 137,000 volts, equals 21,500 kva.

Fifty amperes reversed excitation necessary to bring generator "down on line" to zero potential, no load condition.

Power factor of generators is high, being above 95 per cent the greater part of the day.

Current in unbalanced approximately 12 per cent under no load conditions on account of the conductors being in horizontal plane.

Under normal load conditions, above 12 per cent is reduced to approximately 2 per cent.

A potential of 4200 volts is induced in a dead section of the duplicate line 100 miles in length, distant 32 ft. center to center.

Line loss at full load is 9½ per cent. In addition, there is 5 per cent loss in transformers, auxiliaries, etc.

Data on Big Creek Transmission Line

General—

Length, 240.41 miles power house No. 1 to Eagle Rock substation, plus 0.74 mile tap to power house No. 2; total, 241.15 miles.

Voltage, 150,000 volts, 50 cycles.

Number of tower lines, 2.

Number of circuits per tower line, 1.

Capacity of each circuit, 57,500 kw. at 0.85 power factor for 11 per cent regulation, using synchronous condensers.

Right of Way—

Width of right of way, 150 ft.

Separation of center lines of tower lines, 82 ft.

Towers—

Normal spacing in valleys where no sleet occurs, 660 ft.

Normal spacing in valleys where sleet occurs, 590 ft.

Maximum span, 2671 ft. (Sunland), 2776 ft. (Kings River).

Maximum span on standard towers, 1822 ft.

Maximum angle on standard tower, 0 deg. 49 min. (Normal span no sleet, 1½ deg. plus wind. Insulators take 45 deg. position).

Maximum angle on anchor towers, 48 deg. designed for 60 deg. 114 deg. 2 min., under special conditions at tower No. 1.

Total number of towers, both lines, 3388.

Average number of towers per mile, single line, 7.05.

Classification.	Standard	Anchor and Angle	Special
Weight above foundation	4300	6450	4485
Weight of steel footings	1305	1605	1305
Total steel per tower	5605	8055	5790
Spread at base with line	20 ft.	24 ft.	20 ft.
Spread at base across line	18 ft.	24 ft.	18 ft.
Height above ground to insulator support	43 ft.	37 ft.	43 ft.

Unit Stresses—

Tension = 20,000 lbs. per sq. in.

$$\text{Compression} = \frac{16{,}000}{1 + \frac{L^2}{36{,}000\ R^2}} \text{ lbs. per sq. in.}$$

$\frac{L}{R}$ for corner posts, 125.

$\frac{L}{R}$ for bracing, 175, except where a larger value is approved by the purchaser.

Minimum thickness of members, 3/16 in.

Unit stress in bolts:

Shear ..... 15,000 lbs. per sq. in.

Bearings ..... 30,000 lbs. per sq. in.

Standard Towers (Design Assumptions)—

(1) Wind load, 22½ lbs. per sq. ft. of exposed area, with or at right angles to the line; wind pressure simultaneously applied to both faces of tower, and

(2) A pull in the direction of the line of 4250 lbs. at the points of support of two adjacent conductors pulling on the same side of the tower, and

(3) A vertical load of 1000 lbs. at each conductor support where conductor is unbroken, and of 530 lbs. at each ground wire support, and of 500 lbs. if conductor is broken, and

(4) A wind load of 600 lbs. at right angles to the line at each conductor support where conductor is unbroken, and of 300 lbs. at right angles to the line at each conductor where conductor is broken, and of 500 lbs. at each ground wire support.

The above loads are simultaneously applied.

Ground wire support designed to withstand an unbalanced pull of 5000 lbs. in the direction of the line.

Anchor and Angle Towers (Design Assumptions)—

Anchor and angle towers are designed for each of the following groups of conditions, only one of which groups is to be taken at a time:

I. (1) A wind load of 22½ lbs. per sq. ft. of exposed area, with or at right angles to the line; wind pressure applied simultaneously to both faces of tower, and

(2) A pull in the direction of the line of 8000 lbs. at each of the three conductor supports, on either side of tower, and of 5500 lbs. at each ground cable support, and

(3) A vertical load of 500 lbs. at each of the three conductor supports and of 260 lbs. at each ground cable support, and

(4) A wind load of 500 lbs. at each of the three conductor supports, and of 250 lbs. at each ground cable support.

II. (1) A wind load of 22½ lbs. per sq. ft. of exposed area, with or at right angles to the line; wind pressure applied simultaneously to both faces of tower, and

(2) A pull at right angles to the line of 8000 lbs. at each of the three conductor supports, and of 5500 lbs. at each ground cable support, and

(3) A vertical load of 1000 lbs. at each of the three conductor supports and of 265 lbs. at each ground cable support, and

(4) A wind load of 600 lbs. at each of the three conductor supports and of 500 lbs. at each cable support.

Number of conductors supported by each tower, 3.

Arrangement, in same horizontal plane.

Number of lightning ground wires, one at first; space for two if needed.

Smallest size angle iron used, 1¾ by 1¾ by 3/16 in.

Conductor—

Material, aluminum with steel core; steel double galvanized.

Composition: Metals—	No. Strands	Cir. Miles	Weight, per mile	Weight, per foot	Elastic Limit, square inch	Ultimate tensile strength, sq. in.
Aluminum	54	605,000	2940	....	13,000	26,000
Steel	7	78,500	1118	....	115,000	195,000
Total	61	683,500	4058	0.77		33,600

Total resistance, 35 ohms per leg.

Maximum working tension allowed, 13,000 lbs. per sq. in. in aluminum.

Stringing tension at 80 deg. Fahr.

Ice allowance 3130

No ice allowance 4740

Type of joints, McIntyre sleeve on steel inside of compression aluminum sleeve.

Ground clearance:

On right of way.....25 ft. at 140 deg. Fahr.

At crossings.....Legal, as required.

Ground Wires—

Number per tower, 1.

Size, ⅛ in., 7 strand.

Material, Siemens-Martin steel.

Breaking tension, 13,000 to 15,000 lbs.

Maximum working tension allowed, 6500 lbs. sleet—2100 ft. span; 5000 lbs. no sleet.

Insulators—

Number, 190,000; 38 per cent of which are on dead ends.

Type, 2565-P Locke.

Diameter, 10 in.

Dry flash-over voltage, 590,000 suspension
720,000 anchor 9 disks suspension

Wet flash-over voltage, 420,000 suspension 11 disks anchor
420,000 plus anchor

Routine Tests—

First test per disk, electrical, flash-over voltage.

Second test per disk, mechanical, flash-over voltage, 5000 lbs. after first electrical.

Third test per disk, electrical, flash-over voltage 5 min. after mechanical.

Ultimate tensile strength, 10,500 lbs.

Maximum working tensile loading allowed, 4250 lbs.

Eleven patrol stations are necessary, each requiring an equipment of tools and material weighing 10 tons.

NEW CAPISTRANO SUBSTATION

BY H. W. DENNIS

(In view of the fact that the interconnection of the vast system of the Southern California Edison Company with that of the San Diego Consolidated Gas & Electric Company's system involves the tying in of 50 cycle with 60 cycle high tension lines, this descriptive article by the construction engineer of the Southern California Edison Company is exceedingly interesting and timely.—The Editor.)

The new Capistrano substation of the Southern California Edison Company is located about one mile north of the old Capistrano Mission on the San Diego Boulevard. The building is of reinforced concrete, with metal sash, wire glass, and metal covered doors

The new substation will be tied to the Edison system by means of a 60,000 v. transmission line, approximately 30 miles long. This line will connect the substation directly with the present Katella substation, which is not far from the city of Santa Ana. This transmission line, at the present time, will consist of a single circuit of No. 2 stranded copper wire, carried on wooden poles; wooden cross-arms will be used throughout, except where the strain is excessive, at which points steel cross-arms will be installed. The line will be equipped with suspension insulators, made up of four standard 10-inch disks, excepting in the fog belts, where five disks will be used.

At the station the line will connect with an outdoor switching station, which will be made up of the necessary outdoor oil switches, lightning arresters, and transformers. The 60,000 v. 50 cycle line will be stepped down to 11,000 v. by means of two 6900 kva. 3-phase Westinghouse transformers. This 11,000 v. current will be carried to the substation in underground conduits. After passing through the frequency changer, the 60 cycle current at 6600 v. will be stepped up at the outdoor station to 70,000 v. by means of two 6200 kva. 3-phase, 60 cycle Westinghouse transformers. These transformers are shell type, oil insulated, water cooled and are equipped with 25 per cent starting taps for the frequency changer. The transformers will be mounted on rails which extend into the substation building; this will allow the transformers to be disassembled by means of a crane which will be installed in the frequency changer room. Both the incoming 60,000 v. 50 cycle line and the outgoing 70,000 v. 60 cycle line will be equipped with General Electric Company's aluminum cell lightning arresters.

The frequency changers, of which two will be installed at this time, are of the General Electric Company's make. The 50 cycle end is rated at 6750 kva., 11,000 v., 10 poles, 600 r. p. m.; the 60 cycle end is rated at 6250 kva., 6600 v., 12 poles. Each machine will have a 25 kw.-125 v. direct connected exciter, equipped with Tirrill regulators. A 15-ton hand operated crane will be installed for erecting the machines.

The system of metering the power will be very complete. Two watthour meters are to be connected to each machine. These meters are equipped with ratchets so that they can operate in opposite directions only, so as to measure either the power delivered to or received from San Diego. In addition to the watthour meters, there will also be installed a curve tracing watt meter with zero in the center of the chart. This will give a very complete record of the interchange of power in either direction.

DOUBLE OVERHUNG FRANCIS TURBINES

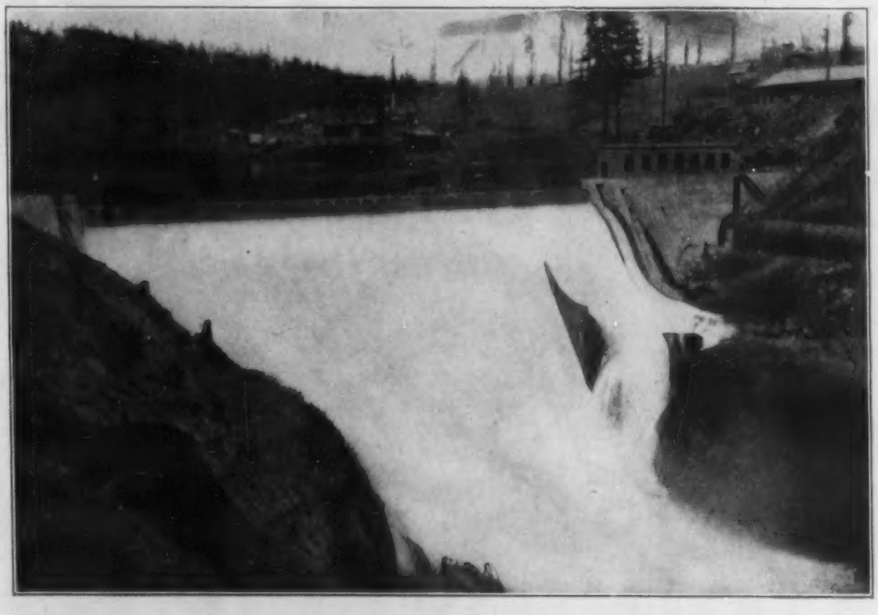
BY ARNOLD PFAU

(The use of large single units in hydro-electric development is connected up with the problems of high tension transmission lines, for to a great extent it has made these possible. The double overhung type of Francis turbine, a comparatively recent development, has already received important application in the West, as here pointed out by an electrical engineer who is an authority on hydro-electric machine design, being in charge of this department with the Allis-Chalmers Company.—The Editor.)

View of White Salmon River Powerhouse, showing penstocks and surge reservoir

Single and double overhung impulse wheels have been used extensively for a number of years, and have proved to be simple, and mechanically correct in design. These hydro-electric units are of the two-bearing type, the rotor of the generator being located between the two bearings, and the impulse wheel placed overhung on one or on both extended ends of the generator shaft. The application of only two bearings to support the revolving weight simplifies the alignment and assures absolutely that each bearing receives its proper share of the total weight to be carried. The impact resulting from the jet produces a force which imposes a continuous bending strain upon the shaft within the adjacent bearing. However, there was no hesitancy in proceeding with the practical application of the overhung type of impulse wheel.

Strange to say, the single overhung Francis turbine is a design which was introduced into practice at a much later date than the overhung impulse wheel, notwithstanding the fact that the Francis runner receives the water not only from one or two or three jets, but from a series of jets uniformly distributed over the whole entrance periphery of the runner. Thus the impact forces are practically balanced, so that the bending strain imposed upon the overhung shaft is reduced to that due to the relatively small weight of the runner itself.

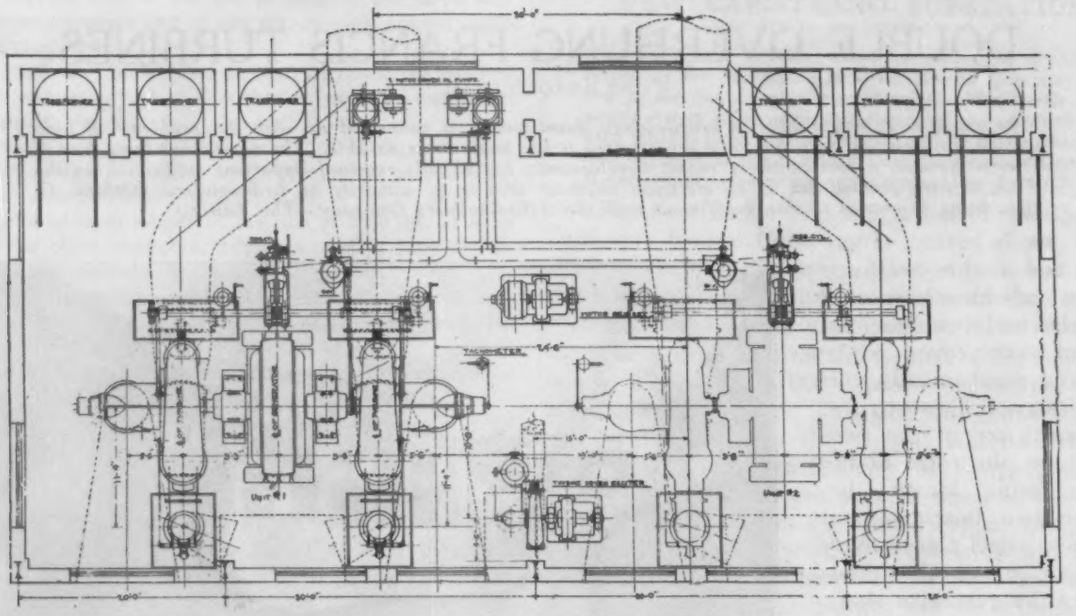


Dam and gate house with 13½ ft. diameter penstock

After the single overhung Francis turbine had proved to be an unqualified success it was only logical to take the next step and use two overhung Francis turbines for one generator.

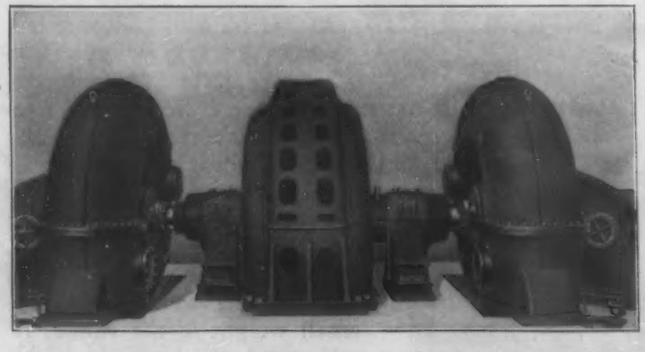
The first two double overhung Francis turbine units were built in 1912 for the White Salmon Plant, Washington, of the Northwestern Electric Company of Portland, Oregon.

The units consist of two overhung Francis turbines of 4500 horsepower each, under a net head of 160 feet and operating at 360 revolutions per minute. The water is brought to



Plan view of White Salmon River Powerhouse

the plant by a wood stave pipeline of record diameter (13½ feet), ending in a large surge reservoir from which two penstocks, each 9 feet in diameter, lead to the power house. Here they are forked each into a pair of branch pipes of 6 feet 4 inches in diameter, reducing to 66 inches where they connect to the four butterfly valves by means of which



Front view of Halsey installation, showing bearings for generator unit

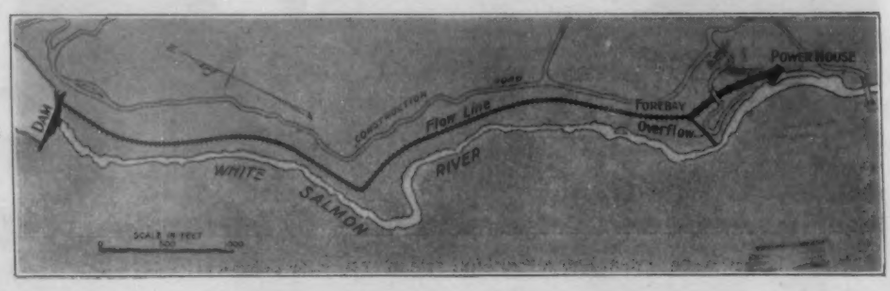
the water can be shut off individually from each of the four spiral casings. The runners are placed overhung on the extended generator shafts and a small stub shaft alone projects through the quarter turn to the mechanical thrust bearing. This shaft does not participate in carrying the weight of the runner.

For each unit an oil pressure governor is used for the control of the wicket gate of the two turbines. The two governors receive the oil from a central oil pressure system with motor driven gear pumps in duplicate arrangement.

Each of the two turbines of one unit is so designed that it forms a self-contained prime mover. The butterfly valves enable shutting off the water so that one turbine may be entirely inoperative except that its runner revolves idly like a flywheel, without causing much resistance, however, because it can be properly ventilated.

The possibility of developing power in only one hydraulic side of the hydro-electric unit permits of increased water economy at less than half load. This is particularly desirable in cases where the flow of the river varies considerably and it can be readily appreciated that the two double overhung units at the White Salmon River Plant are very flexible, economical and efficient. The units embody practically four independent hydraulic prime movers, no turbine shafts are required and the power house space is smaller than that of any other type of turbine. They are especially efficient because the turbines can always be operated at a favorable gate opening, the discharge from each runner being led separately into the tail race and no heavy shaft obstructing the flow of the water in the quarter turn.

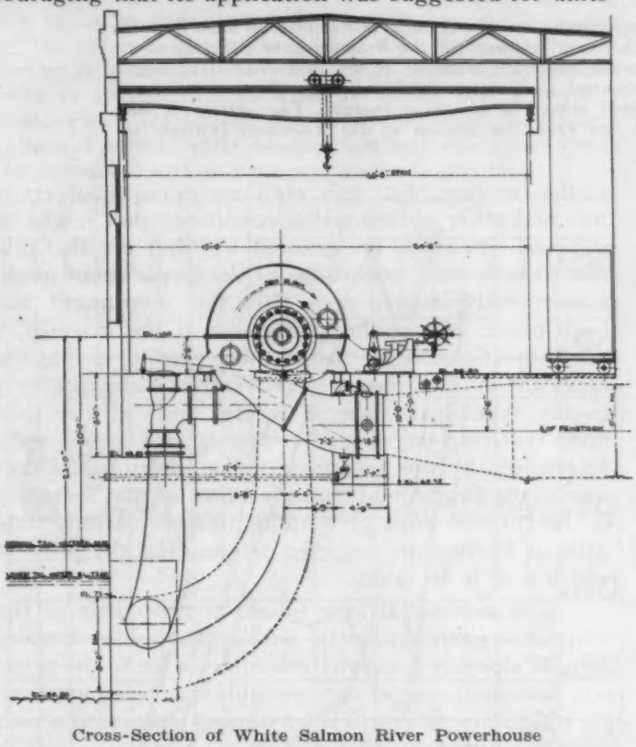
These units have been in continuous operation for five years and no replacements have been necessary, and none of importance will be necessary for a num-



Map of White Salmon River Plant Development

ber of years, judging from the results disclosed by a thorough examination made in the spring of 1917.

The success of this new type of unit was so encouraging that its application was suggested for units



Cross-Section of White Salmon River Powerhouse

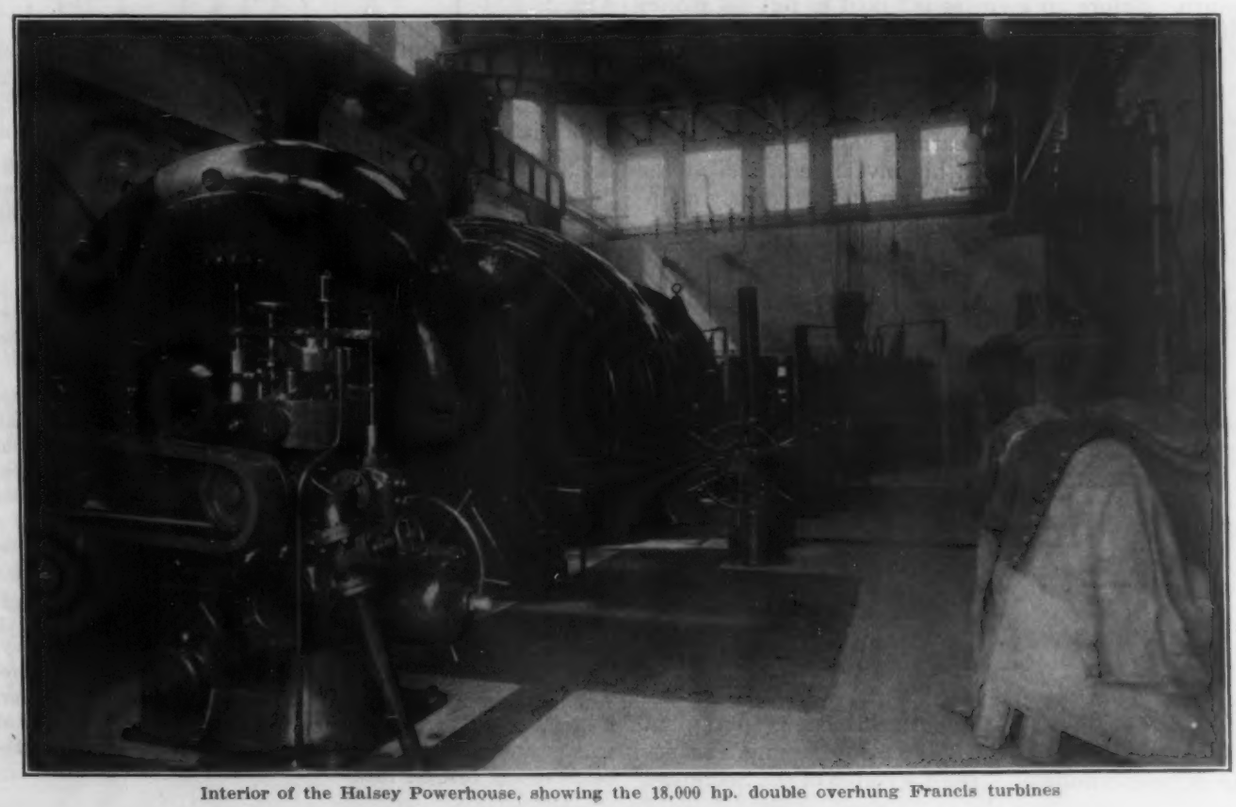
of record capacity. When the Halsey Plant of the Pacific Gas & Electric Company was decided upon, an 18,000 horsepower unit of this type was installed.

Not only was the capacity of the Halsey unit doubled as compared with the White Salmon units, but a further step was taken towards making the hydraulic sides entirely independent of each other. Similar to the 23,000 horsepower double overhung impulse wheels at the Big Creek Plants then under construction, each hydraulic side was equipped with its own individual governor.

It is thus possible to operate both sides simultaneously, or one side at constant gate opening by blocking the governor of that side, regulating with the governor of the remaining side, or to shut one side down completely. It is interesting to note that the hydraulic end was designed to fit the electrical part, inasmuch as the generator, for reasons of uniformity, was made an exact duplicate of that used in connection with the double overhung impulse wheels of the Drum Plant, then also under construction.

The Halsey unit turned out to be a complete success, to the great satisfaction and credit of all connected with the work. Such successful engineering achievements serve to inspire and strengthen the mutual confidence among all co-workers and they cannot help but stimulate the tendency towards going beyond actual precedents. This tendency unfortunately is usually discouraged by a too conservative commercial policy.

The Pacific West is blessed with exceptionally large deposits of "White Coal," the snow capped mountains furnishing the waterfalls for industrial development. This in itself offers opportunities to the engineer of the Pacific Coast which cannot be equally shared by the engineer in other parts of the United States. Opportunities alone, however, will remain idle if they are not grasped by those acquainted with them. It seems that it is the special gift of the Western engineer to discover opportunities, to grasp their full value, to "go ahead" and make use of them.



Interior of the Halsey Powerhouse, showing the 18,000 hp. double overhung Francis turbines

INTERCONNECTION AND NEW POWER DEVELOPMENT

BY P. M. DOWNING

(Interconnection and the demand for new power developments are matters of prime interest in these days of fuel shortage. Here is an article on this subject by the chief engineer of the hydro-electric department of the Pacific Gas & Electric Company, who has been made operating manager of the vast systems of interconnection of the great power companies of north central California, which comprise the greatest combined area in the world served by an interconnected system of electrical energy. The article is abstracted from a recent paper presented before the San Francisco Section of the American Institute of Electrical Engineers.—The Editor.)

It is a matter of common knowledge that there is a very serious power shortage in California, particularly in the central part. The business of the different power companies has made a wonderful growth in the last few years, but the construction of new facilities to meet the increased demands for service has not kept pace with the growth of the business. Some idea of this increase may be had when I say that in 1900 the installed hydro-electric capacity in the territory north of Merced, that is, the territory north of that supplied by the San Joaquin Light & Power Company, was, approximately, 15,000 hp. By 1917 this had increased to 375,000 hp., an increase in the seventeen years of 360,000 hp. In addition to this 375,000 hp. of hydro capacity, there is now installed 187,000 hp. in steam plants.

Although there is an abundance of undeveloped hydro power well within distances that it could be economically transmitted to the Bay Counties, it has been allowed to lie idle for no other reason than that capital could not be interested in its development. These projects are unattractive not because of physical or engineering reasons, but solely because their development and utilization are unattractive financially; in other words, they are not looked upon as good investments. Capital can be otherwise invested where it will be more secure, and where it will yield a better return. Before an investor is asked to put his money into any enterprise, he must first be assured that the investment is a reasonably safe one. He must know that there are equities back of the project that will secure him against loss. He must also know that the enterprise is one with an earning capacity that will insure him a fair return on his investment, and at the same time leave a reasonable surplus to properly maintain the property. Public utility securities, unfortunately, have not always afforded all of these inducements, with the result that money has not always been available when it became necessary to provide new facilities for carrying increased loads.

This condition has been brought about, first by the refusal of rate regulating bodies to establish rates that would yield the utilities a return on their investments comparable with the returns on capital invested in other unregulated enterprises, and secondly by the attitude of the Federal Government in the matter of refusing to grant to power companies anything more than temporary permits for the occupancy of public lands. The radical ideas and rulings of the conservationists have for years been a stumbling block in the way of hydro-electric development. Under existing regulations of the Department of the Interior, no one can enter upon any public land within the Forest Reserve for the purpose of constructing any part of a hydro-electric development, except by signing a revocable permit terminable at the discretion of the Secretary of the Interior. Not only are these permits subject to this and other objectionable conditions that might be imposed when they are granted, but they are also subject to such other conditions as the Department might subsequently impose even after the investment has been made. From the standpoint of the investor, a very objectionable feature of these permits is that the applicant must agree to turn over the entire property to any municipal, state or federal body at any time upon receiving payment therefor, a price to be finally determined by the Secretary of the Interior; in other words, the investor at the discretion of the Secretary of the Interior must give up his property at any time without having any voice in determining the price at which it is to be taken.

It is immaterial how much, or how little of the completed project may lie within the public domain, there is absolutely no way to acquire a fee to the property occupied, and the only possible way to secure even the temporary easement is by signing the permit which would involve the entire project.

As a very large part of the undeveloped water power resources in this state are so situated that at least some portion of almost every development would fall within the Forest Reserve, it will at once be apparent how far reaching a requirement of this kind would be.

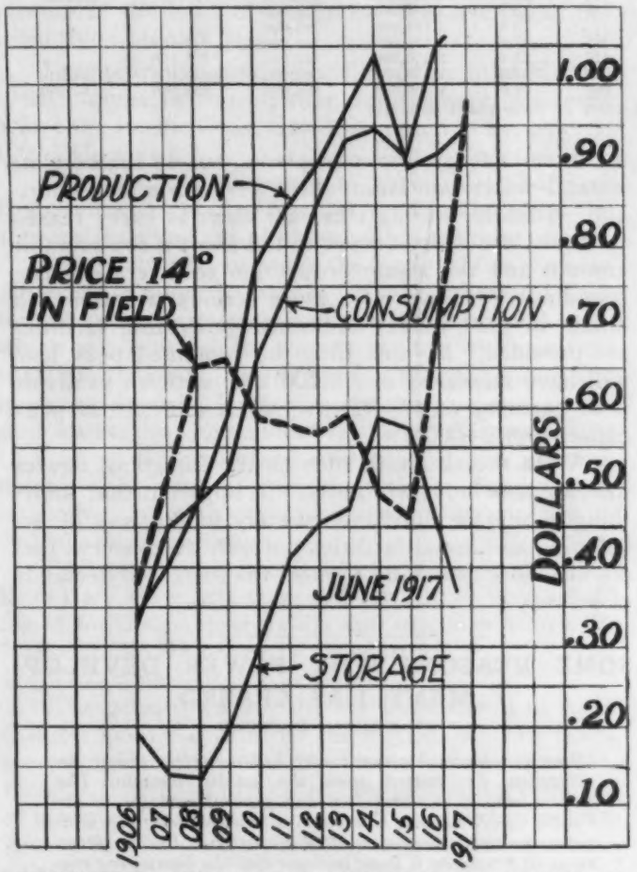
A recent report made by a special committee of the Chamber of Commerce of the United States appointed for the purpose of reporting on water development as affected by the policy of the federal government contains, among other statements, the following:

One of the first things to be clearly perceived, for an understanding of this subject, is that water-power developments are not exceedingly profitable undertakings earnestly sought by capital as a means of securing large returns on a small investment; but that, on the contrary, steam power is the superior to water power in almost all respects. In order to procure the adequate development of water power, inducements must be offered.

There is a very general, but entirely erroneous, belief that any water power running to waste can be utilized at small expense. The initial cost of a steam plant is in general but one-half to one-fifth that of a water-power plant of equal capacity. Moreover, because a steam plant can be more easily enlarged from time to time, the initial development of a water-power plant must, in general, be a much larger proportion of the ultimate contemplated development than in the case of a steam plant. It follows that the investor in a water-power plant is burdened from the very start with a heavy fixed charge, the failure to meet which may mean bankruptcy. The risks to capital in water-power developments are, therefore, much greater than the risks in the case of steam power. The advantage of water power lies in its smaller expense of maintenance, due to the smaller amount of labor and the absence of any cost for fuel.

Water powers will not be developed unless the conditions are made comparatively favorable. Present demand for the development of such power comes, not from capitalists, but from communities which, on account of the high price and scarcity of fuel, are desirous, in their own interest, of inducing capital to make such developments.

In order to secure the adequate development of water power, it is essential that the subject should be approached with an attitude of mind which recognizes the necessity of making such developments attractive to capital, rather than with that attitude which assumes that such enterprises should be surrounded with as many restrictions as possible.



PRODUCTION, CONSUMPTION AND STORAGE OF FUEL OIL
In order to read in millions of barrels, multiply the vertical column headed "dollars" by 100, thus the production of 1912 was 90 million barrels.

This short-sighted policy on the part of the federal government has retarded hydro-electric developments and forced the companies to take care of their increased load with steam generated energy.

With oil as cheap as it was prior to 1916, the modern steam turbine, with its high efficiency, its low first cost and the guaranty of the investment, gave promise of being a real competitor of the hydro installation. However, during the past two years, the production of oil has decreased and the consumption increased, thus necessitating a very heavy draft from storage. As a result, the approximately 35,000,000 barrels of oil in storage in 1916 is being depleted at the rate of, approximately, 1,000,000 barrels per month. If the present ratio of production to consumption continues, the entire storage will be exhausted by 1920.

In view of the government's activities in building up a merchant marine, and the general industrial activity throughout the entire country, there is but little doubt but what even with the increased activity in developing new wells, this shortage will continue. The prevailing high price of oil will be an incentive for greater production by the development of new properties.

The active producing period during which the oil wells of this state can be economically operated, is probably not to exceed twenty to twenty-five years. Records of the decline in production of wells in the various fields show that during the first five years of the well's life, the production drops off, approximately, 75 per cent. As the number of wells in the different district increases, it is reasonable to say that this rate of decline will also increase. With these facts before us it would appear that the added supply to meet the increased demands would have to come almost entirely from new wells rather than from those now being operated.

The sources of the world's oil supply amounting in 1915 to 427,695,347 barrels, shows that a very large proportion of the total is produced in the United States. During that year the production in this country amounted to 281,104,104 barrels, or 65.72 per cent of the total. Russia came next with 68,548,062 barrels, or 16.03 per cent of the total. Of the total United States production amounting to 281,104,104 barrels, the California fields produced 89,566,779 barrels, or, approximately, 32 per cent of the total. Only one other field, viz: the Kansas and Oklahoma, produced more than this state. Here the output was 121,920,000 barrels, or 43 per cent of the total.

The largest individual users of fuel oil are the railroads, their consumption being, approximately, 40 per cent of the total. Steamships come next with, approximately, 13 per cent of the total, and public utilities third with 10.8 per cent.

The success attending the operation of railroads that have been electrified during the past few years, demonstrates beyond a doubt that the problem of changing over from steam to electric operation is one of economics rather than engineering. With oil as the only fuel that is economically available in this state, and the price of this commodity continually increasing, there is every reason to expect that before many years many roads now operating by steam will be changed over to operate electrically, receiving their power from hydro-electric sources.

With steamships the situation is an entirely different one. Here the motive power must be had from fuel in some form or other. Oil occupies less space, is more easily handled, and is a better fuel in every respect than coal. With a larger merchant marine, the demand for oil for shipping purposes will be materially increased, and in view of the encouragement and support now being given by the federal government to this industry, it is safe to say that every possible effort will be made to encourage the industry by the conservation of oil for this purpose.

Public utilities use oil for two purposes, the first and larger usage being for the manufacture of gas, the other for the operation of steam driven electric stations. For the manufacture of gas there is no economical substitute for oil. Coal could be used were it

ACTUAL PAST LOADS AND ESTIMATED FUTURE LOADS

(Comprising the Following Companies: Pacific Gas & Electric Company, Great Western Power Company, Sierra and San Francisco Power Company, Northern California Power Company, Cons. Western States Gas & Electric Company, Stockton System.)

Expressed in Millions of Kilowatt Hours

Year—	Total Load	Hydro Used	Estimated Hydro Available	Steam Used	Estimated Steam	Per Cent of Steam to Total	Oil required for Steam in Barrels	Peak in k. w.	Present peak capacity of steam and hydro during draft on storage in k. w.	Deficit of Peak Capacity in k. w.
1915	1,223	915	.....	218	...	17.8	1,090,000	216,000	.....	.....
1916	1,357	1,151	.....	206	...	15.2	1,030,000	239,000	.....	.....
1917	1,507	1,268	.....	239	....	15.8	1,195,000	265,000	.....	.....
1918	1,665	.....	1,380	...	285	17.1	1,425,000	294,000	338,000	.....
1919	1,850	.....	1,380	...	470	25.4	2,350,000	327,000	338,000	.....
1920	2,050	.....	1,380	...	670	32.6	3,350,000	362,000	338,000	24,000
1921	2,280	.....	1,280	...	900	39.5	4,500,000	403,000	338,000	65,000

NOTE:—The above figure assumes operation of all plants at 100% of their plant capacity.

available in sufficient quantities, and at the right price, but at the prices that have always prevailed in this state, gas could not be produced and sold at a rate that would permit of its being used as generally as it is today. Steam generated electric power can be supplemented by hydro generated. It was to accomplish this purpose and to conserve all oil by the utilization of all of the available hydro energy of the different power companies in so far as it was possible to do so, that the present power interchange arrangement was entered into between the companies operating in this vicinity.

Due to abnormal climatic conditions no large quantity of oil has thus far been saved by the interconnection. With an unusually dry season lasting from April, 1917, to February, 1918, the stream flows throughout the entire state are much below normal, and none of the hydro plants have been able to operate at anything like their normal capacities. The precipitation to date for the winter of 1917-17 is not more than 50 per cent of normal, and unless we have unusually late storms during the coming spring, a very serious shortage of hydro-electric power may be expected before the flood water season of 1918-19. This shortage of hydro power will have to be made up from the steam plants. Not only will these steam stations have to carry the added load thrown upon them by an unprecedented water situation, but will also be called upon to carry the normal increase in load amounting to between 10 and 11 per cent.

No new hydro plants are under construction at this time to relieve the situation and reduce the oil consumption. Under present financial conditions there is but little probability of anything being done in the way of making developments, but even if money, material and labor were all available immediately, it would require two years to complete any installation large enough to be much of a factor in accomplishing the desired results.

The combined loads, actual and estimated, with sources of energy supply, oil required, combined peak loads and peak capacities, of the five larger systems operating in the north central part of the state, viz.: Pacific Gas & Electric Co., Great Western Power Co., Sierra and San Francisco Power Co., Northern California Power Co., Cons., and Western States Gas & Electric Co., are given in the following tabulation. The figures showing the estimated hydro available for 1918 to 1921, inclusive, do not contemplate any additional energy from new plants, but do contemplate normal water conditions with a very decided shortage. Thus far during this year there is every reason to expect the hydro output to fall short a considerable amount and the steam production to increase correspondingly. However, a more serious situation will obtain in 1920, unless additional generating facilities are provided. By this time the combined peak load will have increased to 362,000 kw., with an available peak capacity of 338,000 kw., or a shortage of peak capacity of 24,000 kw.

With the situation such as the foregoing figures indicate it to be, it will at once be apparent that something should be done immediately in the way of developing additional facilities not only to conserve fuel oil, but more especially to meet the increased demands of service.

SOME REASONS WHY POWER DEVELOPMENT HAS CEASED

BY JOHN A. BRITTON

(Here are forceful reasons why hydro-electric power development has ceased upon the public domain. The author, who is vice-president and general manager of the Pacific Gas & Electric Company, is now in conference with governmental authorities at Washington. Recent utterances of President Wilson indicate that the hampering regulations that have prevailed hitherto will soon be removed in order that utility growth and operation in the West may be maintained at its highest efficiency.—The Editor.)

The hydro-electric installations in the North-Central part of California have increased from a total of in 1900 of approximately 15,000 horsepower to a total today of upwards of 375,000 horsepower, with installations in addition of steam of 187,500 horsepower.

The necessity for the conservation of water and additional development of power brought the power companies into contact with the United States Government in relation to the occupancy of public lands, due to the extension of forest reserve boundaries and power-site withdrawals, and immediately the departments of the Government having charge of such lands instituted rules and regulations governing such occupancy which made burdensome the utilization of government lands for the purpose of developing the ultimate power of this State. These rules and regulations have been a constant source of contention and have been brought into courts in numerous cases by the power developers on the ground that the Department of the Interior and the Department of Agriculture in

their control over public lands, and lands within the forest reserve, were exceeding the power and authority granted by Acts of Congress.

The most noted case that brought to an issue many of the questions involved was that of the Beaver River Power Company against the United States, recently decided by the Supreme Court of the United States on an appeal to the District Court for the District of Utah. Unfortunately the decision did not touch upon the most vital question of the right of the departments to make rules and regulations in contravention of the laws of Congress—the case being decided upon other issues.

I quote from an address delivered by John Martin, noted pioneer in water-power development, delivered before the Pacific Coast Gas Association in September, 1909. He says:

"The National Government, through its Forestry Department, is placing various restrictions upon the appropriation and use of water within the reservations.

"The only control which the National Government can exercise upon the waters within the State of California is due to its rights of ownership to land upon which or over which the water travels in its downward course to the ocean, and by placing the restrictions and imposing financial burdens upon the proposed use of said water, the Government is thereby increasing the cost of power purchased and placing the development of said water at a serious financial disadvantage in competition with other plants which are already installed and in operation.

"All water rights in California (except on public lands) are state property, and laws have been established for their appropriation and use, over which the National Government has no control."

This statement is true today.

The permits granted by the Department of Agriculture, having control of the Forest Reserve lands, are revocable at will and of such a character as to prevent, as they have prevented, the proper development of power projects in this State. I will quote you from Article 28 of a permit, which is a sample of those required to be taken out by applicants for the use of government land.

"That upon demand therefor in writing from the Secretary, the permittee will surrender the permit to the United States or transfer the same to such state or municipal corporation as the Secretary may designate, and on the conditions specified in this article will give, grant, bargain, sell or transfer with the permit (upon such demand and upon said conditions) the power project as defined. Such surrender of transfer shall be upon condition precedent that the United States or such transferee shall pay to the permittee the reasonable value of all of such works, etc. Such reasonable value shall be determined by mutual agreement between the parties in interest, and in case they cannot agree, by a body of arbitration of three members."

No provision, you will note, is therein made for an appeal to the courts to determine the value of the property, nor does it provide any values for initiative or risks.

Throughout the permit it provides for its revocation for causes which may be determined by the Secretary. It imposes a tax burdensome in its nature, not only for construction purposes but still more burdensome for operative purposes; and, further and most vital of all, it does not provide for any severance value where the power project is separate from a distribution system.

It must be clearly evident from a casual reading of these provisions why capital has been shy in investing in projects that might, overnight, be deprived of their value.

As illustrating the control that the Federal Government has over the water power possibilities of our State, a control obtained by extension of forest reserve boundaries and by power-site withdrawals, it is a fact that of the maximum potential water horsepower that may be deevloped, the Government controls 94.3 per cent of the lands necessary for the perfect development of power projects, and of the total of said maximum potential water power, but 4.3 per cent has been up to the present time developed, while in the original states, or states not classed as public land states, the percentage of development averages approximately 30 per cent. This is merely illustrative of the restrictive power, by reason of governmental regulations, upon developments within public-land states.

Within the realm of power assumed by the departments, and for which it is respectively submitted there is no color in law as yet sustained by the Supreme Court of the United States, the departments assume that in the minor occupancy of governmental lands rules and regulations governing the whole project or its absorption by the Government at its pleasure will prevail.

There is a power project in this State having a potential possibility of 200,000 horsepower, which has been built so far as its reservoirs, flumes, forebays, pipe lines and powerhouses are concerned, entirely upon land, aggregating 12,578 acres, owned in fee by the power company, with the single exception of 38.7 acres of land overflowed by one of the reservoirs. These thirty-eight acres have been placed in the forest reservation. It is land barren and bare of any vegetation; granite rocks rising above other granite rocks, upon which vegetation would be impossible, and yet because the flooding of this meager acreage by the backing up of the water from the dam impinges upon the alleged Forest Reserve, the Government demands that all parts of the project shall come under the control and domination of the Government and shall be subject to the provisions and permits heretofore quoted.

In another instance there is a power project having a potential possibility of 250,000 horsepower, in which less than two per cent of the entire land devoted to the project is upon Government reservation. The project could be developed (but the power would be lessened some ten per cent) by moving down the stream a few feet, and the project would then be entirely without the forest reservation. Patriotic duty would seem to impose upon the promoters of this project the utilization of the water to the fullest extent possible, yet these conditions of patriotic submissal would result in cost charges and obligations that would render it impossible to finance the project under the conditions imposed by present rules and regulations of departments.

ADVANCES IN MULTIPLE ARCH DESIGN

BY L. R. JORGENSON

(In view of the wide interest throughout electrical circles in the West attaching to the storage of water for the great hydro-electric developments of this region, it is important for our readers to be familiar with the various types of dams in use and their technical details. The multiple arch dam, its possibilities and limitations and the principles of its design, will be discussed in this and succeeding issues by a well-known authority on this type of dam design.—The Editor.)

Gem Lake Dam, showing general plan and type of foundations

DURING the last few years several multiple arch dams have been built in various parts of the country, and they have so far been very successful in operation. Many more would undoubtedly have been constructed had a thorough knowledge of their design and construction been more general among dam building engineers. There are places where rock or earthfill dams, or a combination of the two, are now built, where multiple arch dams could have been constructed more cheaply and more substantially.

While a rock or earthfill dam can, under ordinary conditions, be constructed with a sufficient although unknown factor of safety, such dams are absolutely unsafe under abnormal conditions, such as when water accidentally passes over their crest. It is a well-known fact that nearly all failures in the past have been due to this cause. Water passing over the crest of a multiple arch dam would not destroy the dam, and for a more or less limited time would not hurt the foundation if this was otherwise at all safe for such a structure. A multiple arch dam requires a good foundation, as the load is concentrated on buttresses and settlement of these would be liable to cause the collapse of adjoining arches. Whenever the foundation is solid rock, however, a multiple arch dam can be constructed, as substantial as any type of dam and more substantial than most types. The stresses and dimensions can be calculated with a large degree of accuracy. The factor of safety of such a structure is therefore known within narrow limits, assuming first-class construction work, and precedence should, on that account, not be given so much consideration as with rock and earthfill dams. These latter cannot be subjected to calculations of stresses, and therefore have to be built mostly along lines dictated by precedence. In general, it can be said that a multiple arch dam of small and medium height (not less than 100 feet high) will cost less to construct than a rockfill dam, and especially a rockfill provided with something better than a wooden upstream face for the watertight cut-off. Only perhaps in rare cases would there be occasion for comparing the relative cost of a multiple arch dam and the cost of a strictly earthfill dam, because if there is enough suitable earth to construct an earth dam, a sufficient good foundation for a multiple arch dam and sufficient good building material for the same is not likely to be found at the same place, and vice versa.

For multiple arch dams above, say 130 feet high, the amount of building material required, and therefore the cost of such a structure, increases quite rapidly, due mainly to the fact that the buttresses become very large and require more bracing. A limit of height is, therefore, eventually reached where it will be more economical to build one single arch across the canyon, unless the canyon be very wide. Where this limit of height for any dam lies can only be found by trying all the types possible of application, as the shape of the dam site has also quite an influence in the matter.

The first thing to be determined in the designing of a multiple arch dam is the length of each individual span. Unless there should be strong reasons for using different span lengths for the several arches making

Downstream face of Agnew Lake Dam, showing spillway openings

up the complete structure, all spans should be made the same to facilitate the form work. Theoretically, the shorter the spans are chosen, the less material is required for the arches. The material required for the buttresses remains theoretically the same, no matter what length of span is chosen. While a dam consisting of small spans takes less material than one where larger spans are used, it may not necessarily be cheaper to construct. The form work becomes more extensive and it is more difficult to place the concrete and reinforcing steel in the resulting narrow space between the form boards than in a wider space. Thin arch walls are more liable to collapse than thicker walls, and thin buttresses would require elaborate bracing to prevent their collapse before anywhere near crushing strength had been reached. It is the arch

that holds the water back, and therefore the water-tightness of the dam is to some extent a function of the thickness of this wall, although to a much smaller extent it depends upon the quality of the building material (concrete) used.

Taking all these facts into consideration, it can be said that the practical, most economical span, lies somewhere between the limits of 30 feet and 50 feet. For high dams the economical span is near the upper limit, and for low dams, near the lower limit. A 40 foot span would be a good average value for ordinary cases, and is chosen in the present instance.

Next to be determined is the length of the upstream radius. It is known that the most economical arch* is the one that subtends an angle of 133½ degrees, and that for variations of about 10 per cent on either side of this angle, the difference in economy is very small. For the dams to be described later the subtended central angle at the upstream face has been chosen 120 degrees, or to be exact, 119 degrees 57 minuites. The volume of the arch has thereby been increased approximately 1 per cent above the theoretical minimum, but the thickness has, at the same time, been increased 6 per cent, thereby decreasing the ratio of thickness of arch to length of arch, which is a desirable feature for structural reasons, at least towards the crest where the thickness is small compared with the length. This also decreases the tendency of percolation by decreasing the area of the wetted surface, and by increasing the thickness of the wall.

With the subtended angle (120 degrees) and the span (40 feet) decided upon, the length of the upstream radius is calculated to be 23.1 feet. To facilitate form work the length of this radius is kept constant from crest to foundation, except as noted later. Incidentally this gives also the most economical arch as the subtended angle is thereby kept practically constant. The arch is given a slope with the horizontal of 50 degrees, in order that the water pressure, acting upon the vertical projection of this slope, may tend to cut down the shearing stress on the buttresses to zero or to some insignificant value.

The arch carries the total waterload, and a large part of the load due to its own weight. A preliminary arch thickness may be found by means of the simple formula $Px\ Ru = qxt$ — (1) in which P equals the water pressure in pounds per square inch, Ru equals the length of the upstream radius in feet, q equals the average stress in pounds per square foot of the area of the dam section under consideration, and t equals the thickness of the dam at any given horizontal elevation.

After the thickness has been determined, at as many points as thought necessary, say at every 10 feet apart in elevation, the weight of the arch can be calculated and the additional arch stress due to this load determined. If the total stress is found to be excessive, a new thickness will have to be decided upon.

*For further information see page 34, Journal of Electricity for January 15, 1917.

WAR TIME PUBLIC UTILITY PROBLEMS

BY MAX THELEN

(Here is a terse statement of some of the war-time activities of the California Railroad Commission which should prove intensely interesting in these days of power shortage and world emergency. The author is president of the Commission. The matter set forth is an abstract of a notabl address delivered recently before the extension division of the University of California in a course on Public Utilities.—The Editor.)

Recently, after conferences between Pacific Gas & Electric Company, Great Western Power Company, the Federal Fuel Administration, the Federal Forest Service and the Railroad Commission, all parties agreed that the combination of the so-called Feather River No. 5 project of Great Western Power Company with the so-called Yellow Creek project of the Pacific Gas & Electric Company affords a possibility of developing additional hydro-electric power in the shortest time at the least expense and in the greatest amount of any large power developments now available in California. The two electric companies have written a letter to the Federal Fuel Administration and to the Railroad Commission, stating that they realize the impossiblity of present and near future development by the use of their own credit, and that in their judgment it will be necessary for the Federal Government to give financial assistance in the proposed development. The companies have agreed that if the Federal Government will consider financing this development, they will use every effort to meet the Government's requirements. It is estimated that at least 25,000 kilowatts of electric energy can be made available in one year's time, that the ultimate development will be approximately 220,000 kilowatts and that the cost for the complete project will be at least $25,000,000.

If the War Finance Corporation bill passes, the Federal Fuel Administration and the Railroad Commission will promptly present this development to the federal authorities and will seek their aid in its execution.

In the situation which now confronts many of our public utilities, the duty of the state commissions is clear. While providing for the continuation of adequate service, it is their duty to act promptly and v gorously on applications for increased rates based on increased operating costs.

Where the usual methods of rate making would result in unusual delays, short cuts must be applied to meet the emergency conditions.

Our public utilities must be kept in a sound and healthy financial condition, so that they will be able to meet not merely the requirements of their existing patrons, but also the additional requirements of the war. The state commissions should not wait until the utilities come to them with their pleas for assistance. It is their duty to inform themselves by their own investigations, if necessary, concerning the condition of the public utilities under their jurisdiction, and to keep themselves constantly informed.

If the state commissions rise to meet the situation, as they are doing in all sections of the country, they will be rendering a substantial service not merely to the utilities and their patrons, but also to the nation itself which is largely dependent for war efficiency on the service of public utilities.

A FUTURE LOAD FOR THE CENTRAL STATION

BY JOSEPH P. COLLOPY

(The success which has attended experiments in the stimulating of plant growth by electricity points to the possibility of this practice becoming profitable ccommercially. As yet no apparatus has been put upon the market in this country, and the field seems an enticing one to the electrical experimenter. The author of this interesting review of the present situation is familiar with Western conditions and writes from knowledge of actual experiments. He is with the engineering staff of the Commonwealth Edison Company.—The Editor.)

At the present time electric current is used in a number of operations about the farm and does the work more economically and satisfactorily than any other power. These operations are varied, consisting chiefly in grinding feed, pumping water for stock and irrigation purposes, running the cream separator and a number of other small chores. In a great many cases this makes a very desirable load for the central station. There is another use for electricity on the farm that promises to be far more important than any of the above mentioned. This is the electrical stimulation of growing plants, or, as it is now commonly called, "electroculture of plants."

The stimulation of plants by means of electricity is by no means a new idea. The credit for the first experiments along this line has been given to Dr. Mainbray of Edinburgh as far back as the year 1746. The experiments were performed on potted plants and a static machine was used to produce the stimulating current. The experiments were varied, but the general scheme was to suspend one terminal above the plant and ground the other. The current was applied for varied lengths of time. These experiments were reported successful. Nearly all the later experimenters using high voltage applied the same scheme. Nollet, a French physicist, took up the subject in the same year. He claimed that electricity increased the evaporation of water and that this was the cause of the increased growth. He reported his experiments as giving very favorable results. Jallabert performed the same experiments as Nollet a few months later with the same results. De Lacepede, in 1779, found the growth and germination of garden vegetables noticeably better. Marat in 1782 performed the same experiments as De Lacepede, only with different plants, and reported favorable results. Bertholm performed a number of experiments along this line and was very well pleased with the results. He was, it seems, the first one to attempt the application of electroculture in a commercial way. Bertholm was also the first one to recommend it as a panacea for plant diseases caused by insects and fungi. About this time De Roziers performed extensive experiments on wheat, rye, peas, radishes and other garden vegetables. He said the experiments were favorable in every way. The plants grew faster, larger, had longer roots, and were free from fungi.

Gardiu of Twin did not find things as favorable as his fellow experimenters. He stretched two wires over his garden and connected them to a terminal of a large static machine, the other terminal being grounded. He reported that the garden began to fail in much the same manner as it would if subjected to a large amount of heat. A man by the name of Ingenhouz planted some seeds in Leyden jars. He also reported negative results. No data concerning current strength, voltage, or water supplied were recorded.

From the year 1800 to 1843 very little experimenting was done. In the year 1844 the problem was again attacked with renewed interest. During this year a number of experiments were performed in some comparatively large plots of barley. High potential wires were stretched over the grain with one side grounded. These experiments were reported favorable enough for commercial use. About this time galvanic electricity was used for the first time. These experiments were performed by burying zinc and copper plates containing about 25 square feet at different distances apart and connected together with a wire insulated from the ground. Some of the best results were obtained with the plates about 200 feet apart. One experimenter used this scheme with potatoes and was faborably impressed. Other experimenters tried this scheme but called it a failure. No record as to the current or voltage obtained were left. A good many other experiments with plates were performed using different impressed voltages, both alternating and direct current. The reports of these experiments contradicted each other in such a way that no conclusion can be drawn from them.

During the last few years a number of experimenters have used both direct and alternating current, mostly at high voltages. One of the latest experimenters performed over 50,000 experiments on as many different potted plants. G. E. Stone has performed a number of experiments on plants in large boxes. The thing that distinguishes his experiments from others is that he measured the current that was used in each case. The current at which he found best results varied between 0.05 and 0.55 milliamperes, although he conducted experiments with currents as high as 1.0 milliampere. He found that the current produced by burying plates in the soil varied greatly with the nature of the soil. Plates 5 feet by 3 feet, 4 feet apart, generally produced a current ranging from 0.02 to 1.0 milliampere, but sometimes reached many times this. He was more impressed with the high tension experiments than with the galvanic ones.

The results obtained from electroculture as applied the last two or three years have been very successful in greenhouses and small gardens. The increase in yield has amounted to as much as 50 per cent for carrots, 17 per cent for cucumbers, 80 per cent for year-old strawberries. Melons have done wonderfully well. In one garden near Chicago that the writer visited, 362 muskmelons, much sweeter and larger than the average melons, were raised on a plot of ground 20 feet square. Sugar beets grow to be a third larger and the sugar content is about doubled. All experi-

menters, without exception, agree upon the benefit to the sugar beet.

A very important factor in favor of electroculture is that the plants under treatment have always been free from disease and fungi. If this simple treatment would prevent rust and smut in grain or the dreaded potato blight it would certainly be worth while without any additional yield.

The reason for increased growth and vigor of plants under the influence of an electric current is a much disputed subject. Some of the earlier experimenters laid it to the fact that electrical stimulation increases the capillary action of the plants; that is, more water was drawn up into the plant, in this way increasing their growth.

To prove that atmospheric electricity has an effect upon plants, experimenters have placed screens over plants and grounded the screen. It is said that the growth of the plants is greatly retarded. In some of our northern countries, although their seasons are much shorter than ours and the temperature quite low, plants grow to full maturity well within the season. Some have claimed that this is due to the fact that they are in the close vicinity of the Northern Lights.

When everything is considered, the field looks promising, but there is a great deal to be done before a definite system is decided upon. Up to date experiments have been tried only upon small beds of plants and not upon a large scale. A method of suspending the wires to permit cultivation has not been perfected. No voltage or frequency has been accepted as standard. The amount of current that can be beneficially applied, or the best time of application, has not been decided. These and many other phases are to be worked out, but on the face it seems but a matter of time.

The amount of power required is not large; three kilowatts being enough for twenty acres, and this to be applied only for a few hours each day. Considering the increased yield, the superior quality of the product and the early maturity, this amount should not prove prohibitive. Gardeners who have seen electroculture tried out are very enthusiastic and are ready to adopt it as a commercial proposition. It seems that the agriculturist is ready to carry his end, but the engineer has not developed the apparatus for his use. Of late a commercial machine has been developed by an English firm, but it seems that none have yet appeared on our American market.

ADVANCES IN WESTERN WATER LAW

BY A. E. CHANDLER

Beasley v. Engstrom, 168 Pac. 1145

The plaintiff in this case commenced the action to recover damages and to secure an injunction to prevent the defendant, an upper one, from allowing excess water from his irrigated land to drain through a natural hollow on the land of plaintiff. The Supreme Court of Idaho held that the defendant had a clear prescriptive right to continue using the hollow for a drain.

The plaintiff claimed that the defendant diverted for irrigation use an excessive amount of water, and that if he restricted himself to a reasonable use of water there would be no drainage waters to cause the alleged damage. The court held that an irrigator "has a right to divert sufficient water to properly irrigate his land, and the fact that, because of its slope, it requires more than does land which is more nearly level cannot defeat his right."

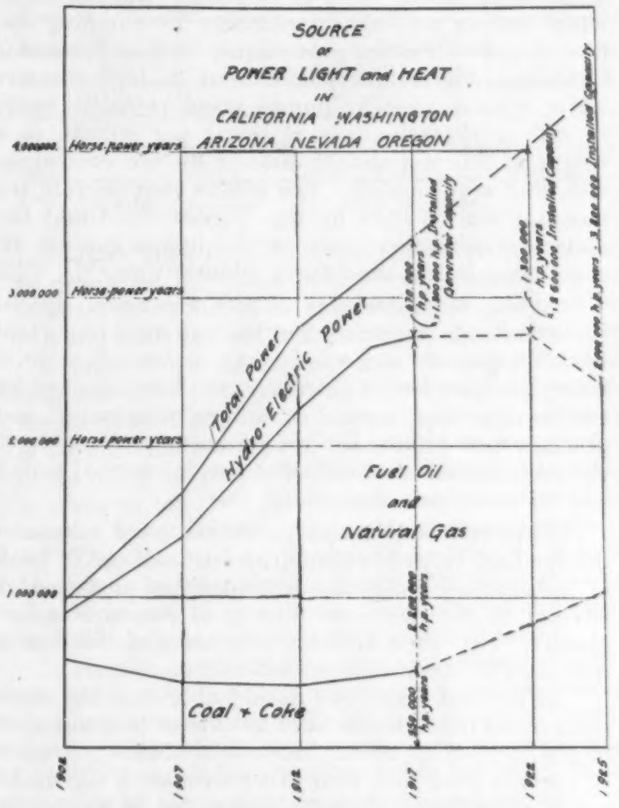
The case is of importance because the Idaho Supreme Court emphasizes the point that what constitutes a reasonable use depends upon the circumstances of each case, and that the method commonly used in the vicinity has a bearing in determining the amount of water to which a user is entitled.

Fearnley v. Haines, 168 Pac. 1176

Until comparatively recently, it was uniformly held that where one built a ditch across the property of another with the unwritten permission of the other, such right of way was revocable. A number of western states now, however, hold that where one has been allowed to construct a ditch, the right becomes irrevocable. In the Fearnley case the Supreme Court of Colorado, in reversing the lower court, upholds this new rule in the following words:

"We have announced the rule many times governing this subject, and it seems unnecessary at this time to more than reiterate the doctrine:

"That where a ditch owner is permitted without interference to construct a ditch over the land of another, and the ditch is put in use, a right of way is thereby acquired, and the necessity for condemning to obtain possession is obviated." Rogers v. Lower Creek Ditch Co., 62 Colo. ——. 165 Pac. 248.



PROSPECTIVE GROWTH OF POWER DEMAND

Here is how Gaskell S. Jacobs, a member of the engineering staff of the California Railroad Commission, estimates that in the year 1925 some 3,800,000 hp. installed capacity in hydro-electric power will become necessary to meet the growing demands for power in the West.

FUEL OIL AND STEAM ENGINEERING

BY ROBERT SIBLEY AND CHAS. H. DELANY

(The taking of test data for economy study in steam electric plants is greatly facilitated by the use of properly designed log sheets. In this article the authors set forth suggestions for keeping tab on the water fed to the boiler, and the oil to the furnace, together with a general log sheet for the complete test. An illustration is also given for the construction of a graphic log sheet that has proved helpful in fuel oil practice. These suggestions are being embodied in a book on the elements of fuel oil and steam engineering—a work of over three hundred pages, profusely illustrated—that will appear for the trade on April 1, 1918.—The Editor.)

DATA SHEETS FOR FUEL OIL ECONOMY TESTS

The Overload Test.—The sudden demands for power during certain hours of the day make an elasticity in boiler steaming qualities absolutely imperative. Otherwise, a great additional expense would be involved in the cost and installation of additional steaming units. Hence the overload steaming qualities of a boiler are of utmost importance, especially in central station or steam auxiliary practice.

As an instance of performance of a boiler under overload conditions on the Pacific Coast, an authentic case is on record where a boiler of 773 rated horsepower developed an overload of 75.7 per cent for 5 hours and still maintained a gross efficiency of 80.62 per cent.

The Quick Steaming Test.—In other instances the ability of a boiler to hastily get into action is of prime importance. This is especially true in cases where boilers are held in readiness for pumping station operation for fire protection. In San Francisco, California, for instance, is located a high-pressure water system whereby pumps stand eternally ready to deliver 12,000 gallons of water per minute to a height of 700 feet should disaster by fire ever again visit that municipality. The boilers that operate the pumping station have by test demonstrated that full boiler pressure and steaming conditions can be accomplished in less than thirty minutes time.

Again, other features of test are under special cases desirable to attain. But the two most important tests are those of ascertaining the conversion ratio of heat represented in the steam to the heat supplied by the furnace under normal conditions of operation and under certain definite overload guarantees—in a word, the ascertaining of boiler efficiency for normal rating and for conditions of overload.

Observations Necessary.—A complete tabulated list for final test computation is set forth in the book of instructions previously mentioned as approved or advised by the American Society of Mechanical Engineers. Let us now look into some of the details necessary to obtain this recorded data.

In the first place, one should note on a log sheet the general observations such as date of test, duration of test, type of oil burner, make of oil burner, number of burners used, and with this information should be compiled sufficient physical dimensions of the boiler to enable one to compute the builder's rating both for the boiler and for the superheater.

During the test period, observations are usually taken every fifteen minutes, simultaneously if possible.

Pressure Readings.—The pressure of the atmosphere is read in inches of mercury and the steam gauge readings of the boiler and superheater having been duly calibrated or corrected for mechanical inaccuracies, are then reduced to absoluute pressure readings as set forth in the chapter on pressures.

The pressure of the oil under which it is forced into the furnace is also usually noted, although it has no bearing on data computation.

The pressure of the draft at various parts of the ash pit, furnace, breeching, and chimney are also noted by means of a multiple cock arrangement which was shown in the chapter on pressures. This arrangement makes possible the quick ascertaining of various draft readings by means of one instrument.

The pressure of the saturated steam and also that of the superheated steam is ascertained by inserting carefully calibrated steam gages, the one in the saturated steam compartment and the other in the superheater compartment. These pressures are then converted into absolute pressure readings by correcting for atmospheric pressure as set forth in the chapter on pressures.

Temperature Readings.—A thermometer is usually located in the atmosphere without to ascertain general external temperature conditions of the day. One is also placed in the boiler room to ascertain the temperature of the entering air passing into the furnace.

To ascertain the temperature of entering feed water and fuel oil, thermometer wells with thermometers are also installed at nearby points of entrance.

It is often desirable to ascertain the temperature of the furnace gases at various points in their journey. To accomplish this thermo-couples are installed at the points desired previous to the firing of the boilers and during the test an electrical pyrometer is advised, especialy if other high temperatures are to be taken in various points of flue gas passage.

The Flue Gas Analysis.—Simultaneously with the taking of the temperatures, pressure and other readings of the test, the flue gas anaylsis is ascertained at frequent intervals. The detailed method of taking these data has been fully set forth in previous chapters and methods of computation of combustion data explained. The Heat Balance will be set forth in full in a later chapter.

The Test as a Whole.—The reader has now before him the taking of the test as a whole. At this point he should carefully review all the previous chapters alluded to in this discussion so as to weld into a solid chain the links that go to make up the boiler test in fuel oil practice.

Having thus in mind a complete idea of the various details involved in the taking of the boiler test data, we are now in position to link together the computed data involved in formulating the engineer's report of the economic results of the test.

Preliminary Tabluation and Calculation of Test Data

The systematic construction of a log sheet that will show in the minutest detail every incident in the progress of the boiler test is of prime importance. It is far better to overdo than to underdo in the gathering of detail data of this kind. The notation of remarks from time to time upon the log sheet concerning relevant observations during the progress of the test is of much service to the engineer when he finally comes to decide fine points in economic boiler performance.

No straight and narrow schedule or log sheet can be set forth to meet all types of boiler test. Each particular test as a rule involves its own particular tabulation. Let us, however, consider a series of tabulation sheets for boiler tests in which oil is used as a fuel. The suggestions that will be set forth illustrate a carefully evolutionized scheme of tabulation for such data that may be well followed in guiding one in the construction of his own individual log form should occasion arise.

The Log Sheet for Weighing the Water.—In the previous chapter we have seen that the water is brought to a definite height in the supply tank the instant of starting the test. Above this supply tank are located standardized scales upon which the water is weighed before emptying into the supply tank below. As a rule, at the closing of each hourly period, water readings are computed in order that the engineer may get a preliminary idea of the progress of the test. Blank sheets are given each water weigher, one to be used for each hourly period. Each sheet sets forth general information indicating the kind of boiler under test, the date of test, the name of the observer, and the particular tank at which each is stationed. A column is devoted to the number of the scale reading, a second to the gross weight of the water and tank before emptying into the tank below, the tare to be subtracted from the gross weight, which is the weight of the upper tank after the water is emptied into the tank below, and a fourth column setting forth the net weight or difference of the two preceding columns.

Log Sheet for Water Fed to Boiler.

Kind of Boiler ----------
Method of Starting Test ----------
Date ----------
Observers at Scales for Water ----------

Reading	Time	Gross	Tare	Net	Temp. of Water	Remarks
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Total	———	———	———		Signature:	

This sheet will have somewhat the foregoing appearance.

By using the type of log sheet above indicated, it is evident that the engineer has a check on his water computation, for in the line marked "total" the footing for the gross weight should exactly equal that for the sum of the tare weight and the net weight. A place is also given for a signature to be appended by the one responsible for the weight notation.

Log Sheet for the Fuel Oil Fed to Furnace.—Simultaneously with the weighing of the water, a similar log sheet is kept by another set of observers setting weighing proceeds, a periodic sample is taken to make forth the weight of fuel oil fed to the furnace. As the up a composite sample for the determination of the calorific value of the oil as set forth in the preceding chapter. The log sheet for the oil is quite similar to that used for the water and should be footed up at the end of each hourly period so that the engineer may have some definite idea of preliminary economic results. A suggestion for this log sheet is as follows:

Log Sheet for Oil Fed to Furnace.

Type and Location of Boiler ----------
Type of Burner ----------
Type of Furnace ----------
Date ----------
Observers at Scales for Oil ----------

Reading	Time	Gross	Tare	Net	Temp. of Oil	Remarks
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Total	———	———	———		Signature:	

Other Data to be Taken.—The tabulation of data to determine the steam used for atomization and the analysis of the flue gases require special treatment, depending upon the particular method decided upon by the engineer to ascertain these factors. Previous chapters have already set forth in detail suggestions for the ascertaining of these quantities, and the reader is now advised to re-read them in order to correlate in his mind, as it were, all the data that must be taken in order to ascertain the economic performance of the modern boiler utilizing crude petroleum as a fuel.

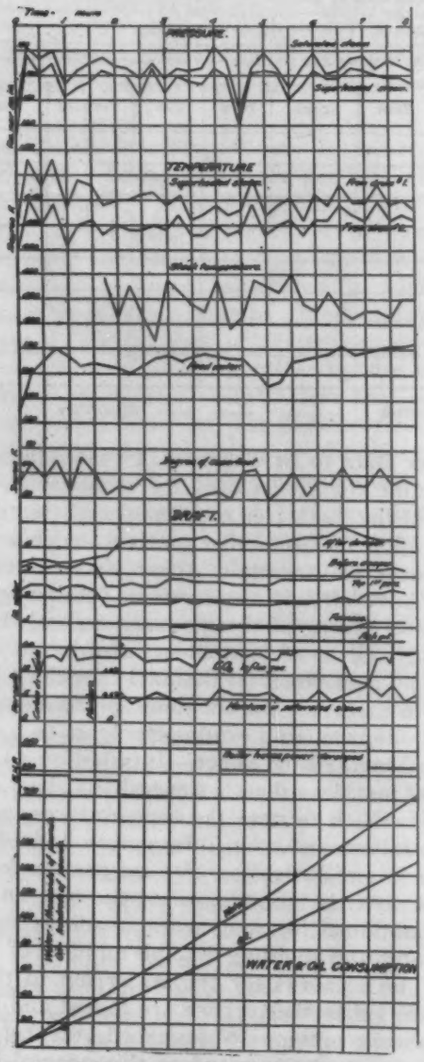
The General Log Sheet.—In addition to the two log sheets just described, a general log sheet is necessary upon which to note the temperatures, pressures, flue gas analysis and other information desired.

Here is an illustration of a suggestion for such a log sheet. At the completion of the test an average is easily obtained for the various readings by footing up the total and dividing by the number of readings noted. The columns for the water fed to the boiler and the oil fed to the furnace are footed and as in the hourly sheets previously described, the totals from these sheets which are noted on this general log sheet should now check — that is, the total gross should equal the sum of the total tare and total net columns.

THE GENERAL BOILER TEST LOG SHEET

General		Pressures						Temperatures								Water			Oil			Remarks
Reading	Time	Atmospheric barometer	Steam pressure (saturated gage)	Steam pressure (superheated gage)	Oil pressure at burner	Force of draft in flue	Force of draft in ashpit	External air	Fire room	Air entering ashpit	Furnace 5 ft. from burner	Temp. of stack	Temp. of boiler at any other pt. desired	Oil at burner	Feed water entering boiler	Superheated steam	Gross	Tare	Net	Gross	Tare	Net	
1																							
2																							
3																							
11																							
12																							
Totals																							
Average																							

Signature of Observer.



THE GRAPHIC LOG SHEET FOR FUEL OIL TESTS

During the progress of a test a graphic plot most conveniently sets forth the behavior of the variables under observation. The above shows a typical graphic log sheet and its method of construction for fuel oil tests.

The reader is to bear in mind that the actual notations to be made in any particular test are not all set down in this general log sheet suggestion. For the information desired and the purpose of the test must in each given case determine these factors. The sheet will, however, serve as a general guide for such matters.

The Plotting of Test Data—As the test proceeds hour by hour, it is very instructive and helpful to keep a diagramatic log sheet also. By this means a glance will often reveal certain irregularities that may be righted at their incipiency. Such a log sheet is shown in the illustration and by reference to it the reader will observe how the history of a test may be simply and clearly set forth.

The Heat Balance

The steaming qualities of a boiler are best set forth by measuring its so-called efficiency. The efficiency of a boiler is the relationship between the heat absorbed per pound of fuel fired and the calorific value of one pound of fuel. Thus although each pound of fuel consumed in steam production is found to have a calorific value of 19,450 B. t. u. in the numerical illustration for this chapter, that portion alone of this heat which is actually represented in the steam itself is of economic value.

In the illustrative test which is made use of in the next discussion, it will be found that of this 19,450 B. t. u. represented in each pound of oil only 14,076.56 go toward power generation. It is then useful and instructive to analyze the losses in a boiler and see through what channels this heat has been dissipated. The major portion of these losses may be easily computed by means of data taken in the test. Those which cannot be mathematically computed are thrown under the column entitled "Stray Losses," and are made to represent such an amount that the total losses together with the useful heat generated in the boiler represent the heat from one pound of fuel.

BUSINESS BUILDING
SELLING IDEAS
DISPLAY

WITH THE ELECTRICAL CONTRACTOR AND DEALER

CONSTRUCTION KINKS
COST KEEPING
ESTIMATING

HUMAN NATURE

BY H. A. LEMMON

(If the man who is selling the goods could just get it out of his head that the customer is a mystery, and begin to figure intelligently just how that customer's mind works, he would be surprised how easy it is. Being able to predict the reaction which your words will produce in the other fellow is the essence of both good advertising and good selling. Some of the elements which underlie selling psychology are entertainingly presented in this suggestive article by a man who is past master in the advertising game.—The Editor.)

The human mind obeys the laws of nature, just as did the apple which fell on the head of Newton.

"A MAN never finds out just how a woman's mind is going to work until it's too late to do him any good," chants a rural philosopher and, because our sales are mostly made to women, many of us are prone to accept this estimate of the vagaries of the feminine mind as a full and sufficient explanation of our frequent and sometimes consistent failure to obtain results.

Perhaps woman herself has aided and abetted the promotion of an idea that she is incomprehensible. It has been stated that a subtle form of flattery is to pretend that you consider the lady of your momentary choice a deep, dark unfathomable mental mystery. She chooses to consider herself that way, and a standard point of attack is to suggest that she is woefully misunderstood by the rest of the world. But as this wasn't intended to be a treatise on how to be successful in love-making, we will content ourselves by merely remarking—Bunk!

The normal human mind is no more mysterious in its working than is a grindstone. What we are vitally interested in is how to best apply the crank.

And right here I am bang up against a most unpleasant necessity—a shock as it were. I simply have to use the word "psychology." Ugh! Of course it makes me shiver also. Applied psychology enables us to take the lid off a woman's brain and watch the wheels go around to see what makes it tick. You don't know what the word means? Neither do I—at least from the expert's standpoint; but for our purposes let's improvise one. It is "guessing what the other fellow will do before he does it"—possessing a knowledge of human nature as it were.

The psychology of figures enables us to foretell with considerable confidence that 2 and 2 make 4. You and I agree upon that: but there are still a lot of fellows who think that 2 and 2 make 22. Instead of accepting the obvious answer to such problems as confront them in every day life, their minds approach each one suspiciously as though it were a "catch" conundrum. They immediately reject the real solution because it is so obvious, and they wander off down the byways and alleys of complication and mystery and ponder and weigh this theory against that one until they are far more likely to entirely lose the original problem than they are to solve it. The man who wrote that quoted opening sentence about a woman's mind is one of them. For the fact is that our minds perform as a general thing, absolutely mechanically and strictly along certain century-worn grooves.

You know what a baby will do if you stick a pin in it—and you know it beforehand. Well, a customer is not so different.

In thinking we think, and in arriving at conclusions and results, we unconsciously obey certain rules and fundamental laws of nature just as surely as though we were adding 2 and 2, or constructing a bridge. Knowing the rules of the game—the 2 and 2 of the mind—we can foretell with gratifying accuracy what appeal will get Mrs. Smith's signature on the dotted line; and we can begin to call ourselves amateur psychologists. And that is positively the last time we are going to use that word.

But to go back. Just for illustration, we will place an average person on our dissecting table and investigate the mental mechanism. Because we must assume a sex and condition of some sort, we will say our specimen is a young mother in moderate circumstances. While she steps into the dining room to answer the telephone we will stick a half dozen pins in her baby who is playing on the kitchen floor. "Ah, ha," you say, "the baby will cry."

Fine! We are getting there, for we have already anticipated a definite mental reaction in the baby. The mother rushes in and catches us at it. She seems annoyed, doesn't she? Great! We have guessed the solution of 2 and 2 again. Simple, isn't it? Being a mother she is of course utterly unreasonable, and after swift attention to the squalling youngster she grabs a poker, a broom, the flatiron and a chair. Why? She doesn't seem to love us any more; and as soon as we have made our escape she has the baby in her arms and is crying and fussing over it. She does love the baby. Later on we may determine that she loves her own baby more than she does other babies. Chalk up those two facts in your brain also. They are a liability against the family pocket book.

So we have found that certain combinations of

circumstances, which we can bring about, may be depended upon to stimulate love and hate in the mind of one who a few minutes before was a perfect stranger. And just as we are able to bring both to an outward expression by our own acts, to that extent at least we learn that we can guide her emotions. For selling purposes it of course is just as well not to arouse her hate—of ourselves. Let us hope that it is confined to her husband or the neighbor's small boy next door. Better still, consider hate a waste product and let it alone.

You can get her if you know what she likes

Perhaps our woman was a promising musician before the details of household cares interfered. Her husband comes home after a stormy parting in the morning and as a peace offering brings two tickets for the concert. She attends and enjoys every moment — that is, every moment that she isn't wondering whether the baby at home is fussing and whether the girl is awake and attentive. Tickets to a concert brought enjoyment. Knowing that she loved music, wasn't it a mere 2 and 2 problem that they would?

Suppose we tell her that her baby is the most beautiful baby in the whole neighborhood. We can extend this territory to include the entire city if we are clever enough to avoid a suspicion of flattery, and mothers of babies are not very suspicious of this sort of propaganda. Is she pleased? Will a girl eat candy? Of course she knew it all the time, and her faith in our keen discernment and uncanny judgment is augmented to a point nearly approaching 100 per cent. Two hours later that baby will have its face washed and will be dressed up to live up to its position as the handsomest baby in the city. Why? Pride of Motherhood.

And we find that by our outside acts we have caused her to feel the human emotions of love, hate, enjoyment and pride. We have absolutely created those passions in her brain, just as we might go on down the list of human emotions and guide her into feeling every one of them. In other words, she experienced just the sensations we previously determined she should experience. The knowledge that certain circumstances (which are under our control) will surely produce certain results in her brain (which to that extent is also under our control), is the salesman's psychol—came near breaking that promise—is the salesman's foundation for a successful career.

There isn't any mystery about it and nothing that any of us cannot learn rapidly and apply. We already have learned it, but possibly have not thought of applying it.

The trouble is that we plain, ordinary fellows who want to be real salesmen, and therefore seek expert information as to the best and shortest manner in which to equip ourselves for the work, are immediately confronted by a lengthy analysis of mental processes and technical discussions which come a bit too fast for our comprehension. And yet it all can be boiled down to what I have written here—that is, if I have succeeded in writing what I meant to write. Those incidents of the baby and the theatre tickets contain the entire foundation principles of the science of salesmanship just as thoroughly and completely as is necessary to enable each of us to qualify—if we will apply it.

Now, it must occur to us that this power to cause any desired emotion in our prospect's mind is placing a tremendous weapon in our hands. In other words, we can meet a perfectly strange lady and force her to feel just what we wish her to feel. If we do admit that this can be done, we also must admit that salesmanship is a science and also that, to use an automobile phrase, "it is perfectly simple and simply perfect."

However, there are ways of arousing a mother's emotions that are more subtle and more productive of orders than sticking pins in the baby. I understand the best salesmen have nearly all discarded that method as somewhat crude and lacking in finesse. A little later we will take these emotions we have created in her brain and endeavor to see how we can use them to our advantage and hers.

A beautiful piece of flood lighting installed by Eardley Bros. of Salt Lake City, which suggests opportunities for contractors elsewhere. The building is that of the Administration offices of the Utah University and is lighted by ten 500-watt type "L-I" G. E. flood lighting projectors. The photograph was taken at 9:30 p. m.

Customer's Comments

("Shopping" is a term whose application is confined to women. That state of mind in which the customer is faintly receptive to any advances which the day may bring is a peculiar opportunity which is yours for the grasping. This remarkable article by a woman who started out in the morning a good "prospect" and who almost bought an electric heater—but didn't—should set you thinking. Would she have made the purchase had she gone into your store?—The Editor.)

One frosty morning as I lit my gas-grate I wished idly for a heater which was inexpensive, attractive and did not leave one with a hot head and cold feet. I knew vaguely that there were electric heaters, but their superiority had never been demonstrated to me, and so the idea slipped out of my thoughts.

I had to go into town on a few errands later in the day, and was loitering by the shops when I was startled by the quick movement and flashing lights of a sign in a show window. I stopped to investigate, and as I marveled a gentle warmth at my elbow drew my attention to a jolly little electric heater out by itself on the street, bearing an invitation to go inside and learn all about it. As I had been wondering about it, I decided to accept with pleasure, and went into the store. After I had closed the door and looked around a young thing unfolded herself and asked laconically if I had come in for something. A little surprised, I assured her I had and began to flood her with questions about the operation of the heater, how it was made, in what points it was superior to its competitors, and finally, why I should get one instead of using my gas heater. She tucked her hair in with artistic fingers and said she really didn't know, but Mr. X. Y. Z. could tell me if I would step in later. So I stepped out, rather regretting that the bright little heater had not had a selling tongue to back up its bright and taking appearance.

Having lost the first thrall of enthusiasm, I still had an unsatisfied feeling which prompted me to pause before a competitive shop down the block. It presented a rather bleak display of grimy looking machinery which was not in the least appealing. My eye wandered to the showcase of the millinery store adjacent, whose bright, attractive picture contrasted favorably with this deadly uninteresting window with its array of articles which bore women. I wondered if the proprietor had ever studied the buying public, especially women? Women are always attracted by beautiful and carefully planned displays. I have been told that most of the merchandise sold from the windows is sold within a few hours after the display is placed.

My meditations were halted when to the rear something glittered, and my interest picked up. Responding to its "come hitherness," I went in. To my surprise, the store was immaculate—with floors that attested many successful trips by the vacuum cleaner. Built in the walls were black-lined cases with inner illumination displaying a few highly polished articles. There was never a duplicate, but each had its separate setting—a toaster, an electric iron, a chafing dish, a coffee urn which shone like silver in a jeweler's beautiful case. I began to make women's visions — surrounding them with white napery, flat silver and pretty breakfast china; I love the "put-put" of an electric percolator. The gleam of an electric heater caught the tail of my eye. I walked to the round table on which it was exhibited and my imagination completed the breakfast room—cozy and pretty, with the charm of the rosy, glowing heater—no dust, no dirt, no difficulty. I looked around enthusiastically to ask the price and to have a few doubts allayed, but—one salesman was carrying on a very pleasant telephonic conversation, leaving his confrere to serve half-a-dozen impatient customers. I strolled around for a few minutes with emotions beginning to cool. The enthusiasm of my picture finally succumbed to the potent arguments of common sense, which included no reason why my gas heater wouldn't do. By that time I had wandered to the door. I was almost grateful that I had gotten out, several dollars in, and had enjoyed the exhibit of wares with trouble to no one.

Having given up all thought of purchase, I paused before another store of electrical appliances out of curiosity. Out of nothing else, for as far as my confused eye could travel, were electric irons, wall plugs, cords, bulbs, lamp shades, nails, screws, till I wondered what on earth it was they wanted to sell me. Crowded merchandise, no sign of lay-out, nothing balanced, the merchandise in the foreground in some cases higher than that in the background, had spoiled the entire effect. In a spirit of fun I thought I would go in just to see what would happen. I had no sooner stepped inside than an eager young clerk pounced upon me and led me off to the heaters. He knew every detail of his goods; every criticism was overthrown; and his enthusiasm became mine. Wondering how I had ever got along without one, I was about to order, when he asked me to sit down a minute to see if I didn't like the temperature. But I saw more than that. Over a motley array of washing machines, vacuum cleaners, batteries, suit cases, dust had settled triumphantly revealed even in the rather bad light. My eye lit on the heater, and I noticed that it was not only dusty, but the copper needed polishing. My gas grate didn't. "Thank you for the trouble," I said, departing. "I'll think about it."

And I thought that the proprietors should have backed up their excellent salesman by providing him with a spotless, dustless space, arranged with a rug and comfortable chairs, in which to make his demonstrations. Then the chairs should be placed in front of an attractive, electrically decorated wall, for when the floor salesman is demonstrating and making a sale, he needs the customer's undivided attention. By arranging the chairs this way, the customers can't see who's passing in and out of the store. They aren't distracted.

But suppose I had been attracted by a well ordered, inviting window and had wandered that first time into a shop whose arrangement and bright up-to-dateness had suggested all the inviting possibilities of that electric heater I was wondering about. Suppose a salesman had talked to me who knew his article and had swept away my doubts by strengthening that picture which he must have known was in my mind. Suppose—but after all, it didn't happen.

And hereby endeth the tale of how I found out that my gas grate had its good points after all.

AN HOURLY SALE

BY W. R. PUTNAM

(A special sale which held its interest through every hour of the day, not only bringing new people to the store but keeping the same ones there to buy and buy again, was the recent achievement of the Utah Power & Light Company's sales department. The interesting story of how the details were worked out is here given for the benefit of those who may conduct similar campaigns on a smaller or larger scale. That it paid is attested to by the figures of sales given at the end.—The Editor.)

As a final wind-up for the excellent appliance sales of the year, we decided to put on a "special" for the last day in the way of a demonstration sale. This was advertised in the Sunday papers as an "Hourly Sale" and consisted of featuring certain appliances at certain hours during the day, feature prices being allowed on the appliances demonstrated. The window was given up to each article in turn as its hour arrived.

A good sized advertisement was run in the Sunday papers

For this plan extensive preparation of all details was made the day before, so that the program could be carried out without trouble or inconvenience. The window trimming was planned out in detail and was put into the hands of one man, who spent his entire time in looking after the displays. A screen was used as the background of the window in each case, which permitted the setting for the hour following the one in operation to be made up and gave ample time for making ready for the change without confusion.

The schedule, with plans in detail, was as follows:

Ten A. M. to Eleven A. M.

The feature for this hour was the Westinghouse toaster stoves, which were arranged about the window with a demonstration table neatly equipped. Hot cakes, ham and eggs, toast, etc., were prepared on this device. The young woman in charge of the demonstration was responsible for having the necessary materials on hand.

Prices

Regular.....$7.00 Special.....$5.50

Eleven A. M. to Twelve Noon

A special salesman was appointed to look after the demonstration of vacuum cleaners, using the necessary materials such as sawdust, lint, etc., to show what a real vacuum cleaner will do.

Prices

With Attachments		Without Attachments	
Regular	$35.00	Regular	$27.50
Special	$27.50	Special	$22.50

Twelve to One P. M.

All small appliances selling for five dollars or less were displayed, consisting of:

	Regular	Special
Westinghouse Curling Irons	$4.50	$3.50
General Electric Toasters	5.00	4.00
Westinghouse Turnover Toasters	5.00	4.00
Universal Toasters, No. 946	5.00	4.00
Hotpoint Eltosto, with rack	5.00	4.00
Hotpoint Elperco, aluminum	8.00	5.00
Christmas Tree outfit, 16 light	8.00	6.50
Hotpoint 4 inch disc stoves 1 heat	4.50	3.50
Westinghouse 4 inch disc stoves 1 heat	4.50	3.50
Large Elboilo	5.50	4.50
Radio Egg Cooker, with milk warmer	....	4.25
Irons	5.00	4.00

The duties for demonstrating these different appliances were assigned to different people, who were responsible for their particular portion of the demonstration.

One to Two P. M.

Provision was made for displaying vibrators during this hour. Heating pads were also included in the demonstration as appropriately combining with the vibrators.

Prices

	Regular	Special
Rex No. 1	$17.50	$12.50
Royal No. 1	17.50	12.50
Royal No. 2	22.50	17.50
Royal No. 3	25.00	20.00
Heating Pads, Hold Heat	4.00	3.00
Westinghouse Heating Pads	8.50	7.00
Universal	8.50	7.00
Elcomfo Aluminum	5.00	4.00
Elcomfo Flexible	6.50	5.00
Hotpoint Foot Warmers	6.00	4.50

The pleasant interior of the Utah Power & Light Company's retail store. Demonstrations were carried out in the window while at the same time the various articles demonstrated were put on sale at special prices within the store. Many sales were made even before the feature sale commenced—and the store was obliged to keep open past closing hours to satisfy the customers. In all $2481.12 worth of appliances were sold in one day.

Two to Three P. M.

A little girl was found to demonstrate the Junior electric ranges.

Prices			
Regular	$8.00	Special	$6.50

Three to Four P. M.

The washer demonstration was put into the hands of one of the salesmen, who was responsible for the window properties, consisting of an Automatic No. 4 and a Thor No. 25.

Prices	Regular	Special
Automatic No. 2	$65.00	$55.00
Automatic No. 4	72.50	62.50
Automatic No. 6	80.00	70.00
Thor No. 25	100.00	90.00
Thor No. 20	80.00	70.00

Four to Five P. M.

The Western Electric sewing machine was demonstrated at this time. Particular emphasis was placed in the display on the advantages of the Sew E-Z motors. Arrangements

Crowds gathered outside the store and then made their way within it to take advantage of the hourly bargains

were also made for the regular type sewing machine, showing the application of the motor, and small tables were provided for demonstrating the regular Western Electric line.

Prices	Regular	Special
Type No. 1	$37.00	$32.00
Type No. 2	48.50	43.50
Type No. 3	58.50	50.00
Sew E-Z motors	15.00	12.50

Five to Six P. M.

The feature of this demonstration was the fancy holiday-ware appliances, consisting of Universal Loving Cup sets and sets of all kinds, with percolators, chafing dishes, etc. Provision was made to demonstrate this class of goods on a tea table.

Prices featured; 10 per cent was allowed on all holiday-ware during this hour.

Seven to Eight P. M.

The same merchandise was featured as described for the hour from five to six p. m.

Eight to Nine P. M.

Universal and Hotpoint ovenettes and grills were demonstrated.

Prices	Regular	Special
Grills, 1 heat	$7.00	$5.00
Grills, 3 heat	7.50	6.00
Ovenettes	3.50	3.00

No distinctions were made between time and cash payments, the prices as given here applying for both.

The attempt was the first of its nature to be tried by a Central Station Company and we looked forward with much interest to the possible returns. We had used fourteen people on our sales floor in addition to two demonstrators. Some sales were made prior to 10 o'clock, the opening of the Hourly Sale. We were obliged to keep the office open until 11 p. m. that night in order to take care of delayed shoppers. The total number of sales made on that one day were 487.

A great amount of material placed on sale at special prices during certain hours was sold during other hours at the regular price. That the sale was a success may be judged by the following record of the day's business:

	Number	Amount
Lamps	..	$222.07
Discs	4	19.49
Toasters	21	113.63
Percolators	19	249.28
Irons	23	107.75
Radiators	5	35.00
Washing Machines	4	280.00
Vacuum Cleaners	25	831.83
Utility Motors	4	48.10
Other Appliances	68	427.31
Miscellaneous	12	66.70
Hughes, Jr. Ranges	11	79.97
Total Sales		$2481.12

PROFIT AND TURNOVER

BY F. B. MILLIGAN

(An interesting suggestion of how to increase your profits without increasing your investment by merely collecting your bills promptly is made here by the credit manager of the Northern Electric Company, Limited. This paper, presented before the recent convention of British Columbia Electrical Contractors and Dealers, is of particular value as coming from a country with problems so similar to our own.—The Editor.)

A serious obstacle to organization work is the large number of retailers who, having but little knowledge of business principles, cannot see the benefit which an organization might give them. It then devolves upon the loyal members of the association to educate these people to the benefits of organization.

Consideration, courtesy and right intent all add to the sum of human happiness. Not only do they benefit those to whom they are extended, but they survive in various forms and add to the well-being of the business world.

Quality plus Service is the basis on which prices are made. Competition in quality and service is a healthy condition, but competition in price alone tends to business ruination.

It goes without saying that we are all in business for the net profits we can make. The two ways of increasing the net profits on a given volume of business are to keep the expenses down, and to increase the gross profits without correspondingly increasing the expenses. We all realize that net profits depend on gross profits and expenses, but there is a keen appreciation of the fact that net profits also depend to a very large extent on investment. The net profit on any particular sale is, of course, the cost of the goods less the expense of doing the business, but the net profit for a year is determined by the number of sales. If a merchant's capital is tied up in an unwarranted investment, the number of his sales, unless his borrowing capacity is unlimited, is necessarily decreased; that is, he hasn't money available for the purchase of goods to sell at a profit, and of course his net profit for the year is reduced.

For example: Suppose that a merchant has an investment in merchandise equal to sixty days' sales (which may be considered a fair standard). Then if his investments in receivables is equal to thirty days'

sales, he has a total investment equal to ninety days' sales; that is (since ninety goes into three hundred and sixty four times), he is turning his investment over four times a year. If the net profit of each turnover is 5 per cent he makes a total net profit of 20 per cent on his investment. Now suppose he isn't so good a collector; he collects in sixty days instead of thirty. Then he carries an investment in receivables equal to sixty days' sales, or a total investment in merchandise and receivables equal to one hundred and twenty days' sales, and gets three turnovers a year instead of four, making a total net profit of 15 per cent instead of 20—a decrease in annual net profits of 25 per cent, as a result of allowing sixty days' credit, rather than thirty; and if he collects in ninety days, he carries an investment equal to one hundred and fifty days' sales, turns his investment over two and two-fifths times a year, and gets a net profit of 12 per cent—a decrease of 40 per cent as a result of allowing ninety days' credit instead of thirty.

Twenty-five per cent on $100 wouldn't feed a big family very long, but 10 per cent on a thousand dollars is four times as much. The rapid turning over gives volume and increases your cash discounts rapidly.

One hundred dollars turned twelve times in twelve months, with a 2 per cent discount every thirty days, will give you 24 per cent margin every year. If you made no greater profit and your capital is sufficiently large, you can make all the money you need.

A good assortment is one of the fundamental principles of a successful retail store. The jobber is best fitted to supply that demand. Quick sales and fair profits bring great results.

Your total net profit for each day is what counts; therefore it is necessary for you to know what you have done today, and if you show no gain try a different plan and work harder tomorrow. You must have a goal and try to make it.

IF I WERE A JOBBER

BY M. L. SCOBEY

(A talk that is well worth while, by a man who, although not a contractor, is in a position to speak from their viewpoint. The author spoke recently on this subject before the San Francisco Electrical Development League.—The Editor.)

I am not in a position to tell you what I would do if I were a jobber, because the jobbers have had their association now for many years, and through that intercourse have pretty thoroughly entrenched themselves, evidently taking advantage of the other fellow's experiences and through the exchange of problems and and ideas, and ideals if you will, have today gotten their separate businesses so well organized and perfected that there is little or nothing to be said in criticism.

However, I have my ideas as to what the dealers would like to have the jobber do—and while these suggestions are not directed at any one particular jobber, they are privileged to take it unto themselves if the shoe fits.

One of the principal items that we deal in is that of socket current-consuming devices, which embraces irons, toasters, percolators, curling irons, air heaters, etc., all of which are procured from the jobber, who, in most cases, is the sole distributor and representative of the manufacturer. Now, I know of only one jobber in the city (and also with one exception I deal more or less with every one of them) who carries an adequate supply of repair parts and accessories for the line he carries and represents.

You can realize that the dealer is not in an enviable position when a customer brings in a broken or defective device and, after leaving it for repairs, makes a special trip the following day to get it, fully expecting, and justly so, that it will be ready. In a great number of cases he has to be told that the needed part is not to be had in the city and that it will have to be forwarded from the factory, taking possibly two or three weeks.

To put it mildly, the customer is disappointed and annoyed, often-times openly blaming the dealer who really is not to blame at all. The dealer then is forced to see a dissatisfied customer walk out of the store. And what the dealer needs to build up his business is satisfied customers, not dissatisfied ones. Now, while the jobber is not directly in on the deal, it eventually reacts on him.

Another thing of importance is the matter of credits. I don't know why it is or why it should be so, but the fact remains that it takes all the jobbers about three times as long to get a credit through their books as it does to get a bill or order. We all make mistakes and sometimes it is the dealer's and sometimes the jobber's employee's fault or mistake—but if a credit is due, why not have it put through as promptly as the rest of their business?

Last, but by no means least, I firmly believe that the jobbers should absolutely close their doors to retail business—and when I say "retail business," I mean retail business in its true sense. Upon investigation I find that jobbers of other lines do not and will not sell at retail, so why cannot the same conditions prevail in the electrical business. When I was connected with a jobber here, I remember waiting on a lady who drove up in her limousine and purchased two Xmas tree outfits at $15 each. She paid full retail price, but if that sale had been made through the dealer, the jobber would have made his legitimate profit, the customer would have had the goods at the same price, and the dealer would have had a chance to perform his function as a dealer should, and every party concerned would be satisfied.

It is a peculiar thing with human nature, but nevertheless a fact, that if a person is given an opportunity of buying at a wholesale house, even though he pays full retail price, he seems to think he has gotten the best of the dealer. The worst part of it is, he has, but he has not benefited himself.

I believe I am safe in saying that any man can walk into any electrical jobber's establishment today and purchase a single socket or attachment plug, or a woman can buy a percolator, provided they pay the same price they would if they bought from a dealer. It is probably true that if the jobber discontinues the practice of selling at retail, he will lose at first by so doing, but, in my mind he will more than make up any such initial loss in the long run.

CHANGES IN THE NATIONAL ELECTRICAL CODE

BY G. A. CLEARY

(An interpretation of the changes which have been made in the 1918 edition of the National Electrical Code, soon to appear, is here given, which will be of particular value to those making electrical installations. New rulings on motors, switches and groundings, a revised general code for moving picture houses and garages, as well as many minor regulations, will be included—and are here briefed in these columns. The author is of the technical staff of the Board of Underwriters of San Francisco.—The Editor.)

The forthcoming issue of the National Electrical Code will embody certain amended and additional requirements, which are of particular interest to the electrical contractor and worker.

The rules in the main are the same as those contained in the 1915 edition of the National Electrical Code. The major changes relate to method of grounding electrical equipment, conditions under which insulating joints may be omitted on fixtures, installation of service switches, motors, electrically operated organs, identifying insulating covering on three-wire and two-wire circuits with one grounded conductor, and construction of junction boxes.

No reference will be made here to sections of the code in which the phraseology has been changed but where the effect of the rule will remain unaltered.

Sec. 1. **Generators:** The safety device or devices must now be so placed as to disconnect the generator from all conductors of the circuit where the generator, not electrically driven, supplies a two-wire grounded system.

Sec. 2. **Conductors:** (b) Conductors having an insulating covering must, where they are closely grouped as on switch boards, in wire towers, cable ways, etc., each have a substantial flame-proof outer covering.

Section 8. **Motors:** (b) Motors operating at a potential between 550 and 3500 Volts must be wired with approved multiple conductor, metal sheathed cable in approved metal conduit. Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheath must be bonded around splices by No. 6 B. & S. gauge copper wire and approved ground clamps.

Where motors operating at a potential between 550 and 3500 Volts are located in a special room or vault adjoining an outside wall and the conductors entering from the outside are not in conduit, the conductors may be rigidly supported on glass or porcelain insulators which keep them at least 1 inch from the surface wired over and not less than 8 inches apart, except at motors and devices.

(b) Conductors carrying the current of only one motor must be designated to carry current at least 10 per cent greater than that for which the motor is rated; this has been changed from 25 per cent, which is now required by the 1915 edition of the National Electrical Code.

Additional percentages of the name-plate rating are mentioned in addition to the 30 minute current rating of motor and now referred to in Sections 8-D.

(c) A switch will be required on the supply side of each auto starter or group of auto starters. In localities where it is customary to provide a switch at the distributing center, to disconnect fuses, and where these fuses are the feeder or starting protection to the motor, it will be accepted as fully filling the new requirements. Where this construction does not obtain a switch will be required immediately ahead of each auto starter or group of auto starters. When an A. C. starter, when in running position, opens all wiring in the circuit automatically under over-load, it may also serve as a circuit breaker.

(c) The percentages of the full load currents of motors requiring large starting currents and where such motors are started by means of auto starters, have been changed to read:

Rated Full Load Current	Percentage
0 to 30 amperes	250%
Above 30 amperes	200%

Alternating current motors operating freight or passenger elevators or cranes that are dependent on phase relation for the direction of rotation, must be protected by approved automatic circuit breakers (or reverse phase relay) operative in the event of any phase reversal that would cause a reverse motor rotation, or in the event of the motor being connected to the line single phase.

Sec. 9. **Feeder Protection:** Oil circuit breakers and switches must, wherever practicable, be isolated from other switches and apparatus; on circuits of over 7500 volts they must be of the remote control type and be enclosed in separate fire-proof cells or compartments.

Sec. 15. **Grounding Low Potential Circuits:** New rule which refers to grounding of direct current and alternating current distributing system.

Sec. 15. (a) **Method of Grounding When Protective Grounding Is Required:** New rule regarding the point of attachment of ground connection on direct and alternating current systems, lightning arresters, ground protectors, electrical equipment, metal conduit, armored cable and metal raceways.

Where the service conduit is grounded its ground conductor must run direct from it to the ground connection. Interior conduit, armored cable or metal raceways if well bonded to service conduit, grounded as provided in the new rule, need no additional ground connection.

Ground Conductors: In all cases the ground conductor must be of copper or other metal which will not corrode excessively under the existing conditions, and if practicable must be without joints or splice.

The insulation and installation of the ground conductor for circuits must comply with all the requirements of the Code for wires of the voltage of the circuit to which the ground conductor is attached, and must have after January 1st, 1919, an identifying cover. In no case shall an automatic cut-out be inserted in a ground conductor or connection, except in ground conductors for equipment where its operation will disconnect all leads connected to the equipment from the circuit conductors.

The ground conductor or conductors for circuits must in general have combined current capacity sufficient to insure the continuity and continued effectiveness of the ground connection under conditions of excessive current caused by accidental grounding of a normally ungrounded conductor of the circuit. No individual ground conductor shall have a smaller current capacity than No. 6 B. & S. gauge copper wire. For the frames of electrical equipment current capacity of the ground conductor must not be less than that provided by copper wire of the size indicated in the following table:

For portable equipment protected by fuses not greater than 15 amperes No. 14 ground wire may be used.

Capacity of Nearest Cutout Protecting Equipment.	Requiring Size of Ground Conductor.
0-100 amperes	No. 10 B. & S. gauge
101-200	6
201-500	4
501 amps. above	2

The grounded circuit wires must not be used as ground wire for equipment, etc., and grounded conductors from equipment, etc., must not be connected to grounded circuit wires.

Sec. 23. **Automatic Cutouts:**

(a) Automatic cutouts must be placed in all ungrounded service wires.

Where service switch, service fuses and meter are combined in an approved self-contained device or compact combination of such devices having no exposed wiring or live parts and no part unprotected except potential coils of the

meter, such potential coils may be connected on the supply side of the service fuses.

(b) Receptacles for attachment plugs are now considered as requiring not less than 40 watts and may therefore be connected to lighting circuits.

Sec. 24. **Switches:**

(a) Must be placed on all service wires, either overhead or underground, at the nearest readily accessible place at the point where the wires enter the building.

Service switches must be arranged to cut off the entire current from all circuits and devices, including meters, except as provided in the following paragraph:

Where service fuses and meters are combined and in approved contained unit device having no exposed wiring or live parts and no parts not protected by the fuses, the switch may be so arranged or installed that it will not disconnect the meter from the supply line provided it does disconnect all lines of the supplied house circuits.

With three-wire direct current or single phase system with grounded neutral, the service switch may be so designed as to permit either outside wire to be opened independently of the other, and the design must be such that the neutral cannot be opened without opening both outside wires. It will be noted that switches may now be placed in the outside wires of single phase systems with grounded neutrals and that they may be opened independent of the neutral; this would mean then that two-pole switches are satisfactory for service switches for three-wire single phase systems and single pole switches on two-wire single phase systems. This change will necessitate absolute certainty of the identity of the grounded conductor where they are connected to the service switch so as to obviate any possibility of improperly connecting the service switch.

Sec. 25. **Heating Devices:** The sub-divided circuits of a heater need not be separately fused.

Where the capacity of the heater does not exced 15 amperes or 1650 watts, an approved plug connector may be employed in lieu of a switch. Switches controlling sub-divided circuits of a heater are not considered to take the place of the main switch called for by this paragraph.

The single pole switches on the individual units of electric ranges are not to be considered as taking the place of the switch for the control of the entire unit.

Sec. 26. **Wires:**

(a) (After Jan. 1st, 1919.) The neutral conductor on all three-wire circuits and one conductor on two-wire circuits must have an identifying insulating covering readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation, properly connected to all fittings to properly identified terminals in order to preserve its continuity.

When one of the circuit wires is to be grounded the ground connection must be made to this identified wire.

(f) In unfinished attic or roof spaces wires to be considered as exposed to mechanical injury and must not be run on the upper edge of joists, except that in inaccessible roof spaces where wires are on the cross joists they must be supported on knobs on the upper edge of each joist.

Unless a five-inch separation is maintained each meter lead must be separately encased in flexible tubing.

Sec. 28. **Interior Conduit:** For sizes not greater than No. 10 B. & S. gauge one more conductor than permitted by the table Size of Conduits for the Installation of Wires and cable may be installed in the specified conduit, provided the conduit is not longer than 50 feet and has not more than the equivalent of two quarter bends from outlet to outlet and the bends at the outlet not being counted.

Sec. 30. **Fixtures:**

New rule indicating when insulating joints and canopy insulators may be omitted on straight electric fixtures connected to knob and tube work, straight electric fixtures connected to metal conduit system or to properly grounded gas piping systems, straight electric fixtures grounded to a separate ground wire and combination fixtures where the gas piping is grounded.

It may be pointed out that this new rule:

(a) Specifically mentions the use of wires with 3-64th inch rubber insulation as one condition for the omission of the insulating joint and canopy insulator.

(b) A further condition is now to be based upon the grounding of fixtures connected to conduit or gas piping systems of fixtures which are separately grounded and the absence of a ground in the case of knob and tube wooden raceway and open work.

It eliminates wholly the former provision for sockets having porcelain or equivalent insulations, thus admitting the use of common brass shell paper lined sockets, etc., on fixtures without insulating joints or canopy insulators.

Under the new rule sockets and receptacles for different attachment to conduit and metal raceways and on outlet boxes and fittings may have paper or fibre insulations between current carrying parts and outer metal shelves provided they are so designed and installed that the shells are permanently and effectively connected to the grounded circuit, metal raceway, metal cover of outlet box, or other similar support, and provided the connecting wires have 3-64ths inch rubber insulation. In other words, on such supports sockets and receptacles of fibre or paper insulation may have grounded instead of insulated outer metal shells or other non-current carrying parts.

This change in the rule makes possible certain changes in the design of the sockets and receptacles expressly intended for use on conduit and metal raceways.

It also permits the use of ordinary "fibre lined" sockets on outlet box covers, condulets, etc., without insulation between the socket shelves and grounded metallic system.

Sec. 32. **Flexible Cord:**

(h) Must, where passing through covers of outlet boxes, be protected by approved bushings expressly designed for this purpose, or the cover must be provided with a smooth, well-rounded surface on which the cord will bear.

Sec. 37. (a) **Electrically Operated Organs:**

New rule applying to those electrical circuits and parts of electrically operated organs which are employed for the control of the sounding apparatus and keyboard.

Sec. 38. (a) **Moving Picture Factory and Studios and Moving Picture Equipments:**

New rule regarding the wiring and equipment in buildings in which motion picture films are manufactured, exposed, developed, printed, rewound, repaired, stored, etc.

Sec. 42. **Garages:**

(c) Flexible cord for portable lamps, motors, or other apparatus must be approved cord designed for rough usage, preferably stage cable or packing house cord.

Sec. 59. **Outlet, Junction and Flush Switch Boxes:**

Junction or pull boxes of over 150 cubic inches in size must be of metal and must comply with the detailed specifications for cutout boxes except that covers may be single flat sheets secured to the box proper by screws or bolts instead of hinges, if desired.

Boxes having covers of this form are for use only for enclosing joints in conductors or to facilitate the drawing in of wires and cables and are not for use of enclosing switches and cutouts or other forms of control devices.

Technical Hints

BY GEORGE A. SCHNEIDER

(The type of cables to be used in interior telephone systems and the methods of installation most to be recommended for time saving and effective work, are matters with which every contractor should be familiar. The information contained in this article and the one to follow is based upon the very latest practice of one of the large manufacturers of telephonic apparatus and accessories and should prove of value not only to the electrical contractor engaged in private practice, but to those entering the government Signal Service. The author is in constant touch with actual problems as they present themselves to the man in the field and his discussion of these difficulties should prove of particular value.—The Editor.)

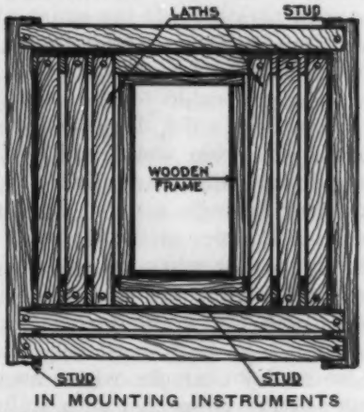
INSTALLATION OF CABLES FOR INTERIOR TELEPHONE SYSTEMS

To insure satisfactory and continuous service of intercommunicating telephone systems, the apparatus and materials should be carefully selected and the installation work carefully done. No matter how excellent the apparatus may be, there is likely to be constant operating trouble and expense for repairs unless the complete installation is done in a thoroughly workmanlike manner, with all connections properly and securely made.

In this article and the one to follow it is assumed that cable will be used throughout the system. The use of cable instead of loose wires is strongly advised in practically every installation except in those cases where less than a total of four wires is employed. The first cost of cable may slightly exceed that of open wire work, but this will be more than offset by the saving in time required for installing cable and the superior and more reliable service obtained.

General Lay-Out of a System

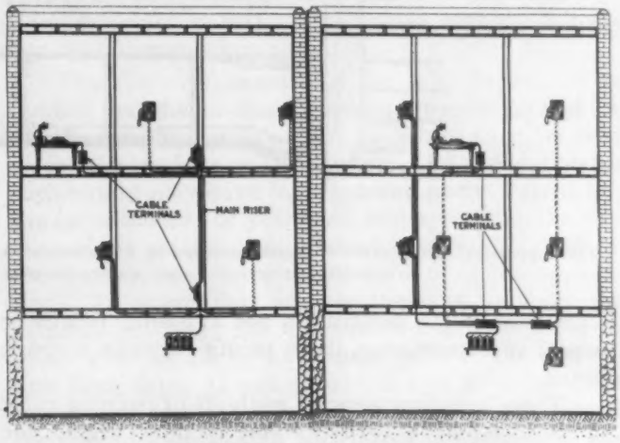
Before beginning the actual work of installation, the exact location of the various telephone stations and cable terminal boxes should be definitely determined. Not more than four cables should terminate in each terminal box. This will be apparent from the description of standard terminal boxes to be given later.



IN MOUNTING INSTRUMENTS

A wooden frame for use with the flush type sets, showing the mounting—Figure 1

Telephones should never be located where they may become injured by a door or furniture, nor placed in the way of passing persons, over radiators, on damp walls or vibrating partitions. Avoid locating them in noisy places, close to windows that are likely to be open in rainy weather or in dark places where it will be difficult to find the correct push button. Where flush type telephone sets are to be used, the outlet boxes, though part of the set, are detachable and can be installed while the building is under construction. The fronts containing the working parts can be attached later. Wooden frames are recommended for use in connection with flush type sets and can best be mounted as shown in Fig. 1. Where non-flush sets are to be used, the walls must be completely finished before the instruments can be mounted. Wall sets should be so mounted that the center of the transmitter will be about 4 feet 10 inches above the floor; a convenient height for the average person.



SCHEME FOR CABLE CONNECTIONS

Two methods of running the cable to the instruments. The use of terminal boxes on each floor is shown in Figure 2 on the left, whereas separate cables run from the terminal box in the basement in the second method, as shown in Figure 3 on the right.

Character of Cable

For interior wiring where no dampness is ever present and where wiring will not be exposed to view, cable with outside braiding treated with gray fireproof paint is recommended. When the wiring is exposed to view, as in connection with hand sets and desk stands, cable with green glazed cotton braiding is standard and is recommended. For wiring inside a building where there is apt to be moisture even in a small degree, and for all outside wiring, lead covered cable should always be used.

In order to identify the various conductors of a cable, at any point, a method of testing and tagging each wire is sometimes used. This practice, however, consumes considerable time and labor and can by no means be considered absolutely reliable. In order to simplify the work of making connections and at the same time assure accuracy it is better to use cable made up with the various conductors covered with insulation of different colors. With this arrangement any wire in the cable can be readily identified at any point without testing. This method is now standard for all telephone and telegraph work.

When only single conductors are obtained in a cable, the insulation of each conductor is colored differently. Whenever two conductors are paired or twisted together, the color of only one of the two wires changes. The wire which changes color in a pair is usually termed the line wire and the other conductor the mate. Whenever possible splitting a pair should be voided in order to prevent unsatisfactory operation of the transmission circuit of the system.

The various cables for interior telephone systems are available in three different styles as regards the arrangement of conductors making up the cable. One style of cable has single wires only; another has a combination of single wires and pairs, and a third style has all wires paired. All wires are No. 22 B. & S. gauge except battery wires, which are No. 16 B. & S. gauge.

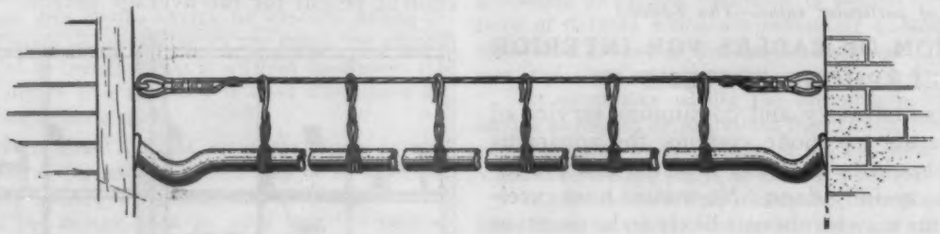
Methods of Running Cable

The manner of installing cable should be definitely determined before beginning the work, and care should be taken to select the best and shortest runs. If an exact plan of the building is not available, it will be helpful in determining these points to make a rough sketch.

There are three general methods of running cable to the instruments. In the first method, Fig. 2, the main cable or riser is run from the basement to a terminal box on each floor and from there separate cables to the various telephone stations. In the second method, the main cable is run from the basement to a terminal box on each floor in the same manner as shown in Fig. 2, but instead of running separate cables from these terminal boxes to each station, only one cable is provided. This makes the circuit of all instruments located on the same floor. If more convenient two cables may also be used, each taking in one side of the building. This method, while not requiring as much cable as the others, is somewhat difficult to install and takes more time. In the third method, Fig. 3, separate cables are run from the terminal box in the basement directly to each station in the system, but not more than four cables from any one box, as previously stated. In case the stations on the various floors are located one above the other it is only necessary to run risers between the floors.

A modification or combination of the methods described may at times be found more economical or convenient, depending upon conditions. In all cases care should be taken in planning the cable runs so they will be inconspicuous. Running cable under or in contact with water or steam pipes or exposing unprotected cable to possible injury should be avoided. Where it is impossible to avoid crossing or paralleling water or steam pipes, the cable should always be fastened above the pipes. Cable should also be kept away from light or power circuit wires. Where a crossing or parallel run is unavoidable, there should be a separation of not less than 6 inches between wires and cable. If the wires carry alternating current a larger separation is necessary to prevent inductive disturbances in the telephone talking circuit.

In non-fireproof buildings cable may be run along picture mouldings, or supported by pipe straps or cable clamps about two feet apart. When using pipe straps, care should be taken to select the proper size for the cable, as cables of various capacities have different diameters. If the pipe straps are too large or too small, the work of installing the cable and adjusting the straps will not only consume more time, but will result in an untidy installation. Pipe straps should be examined for sharp edges and points which might penetrate the cable and injure or short circuit the conditions.



CABLE SUPPORTS

The supporting of the cable between buildings by a messenger wire. Note that this support is securely anchored to either wall. The drip loop insures the rain water dropping off at this joint before entering the building.

Porcelain tubes should be used as bushings for holes in walls through which the cable is to be carried. When cable is run on the face of a wall, on or near the floor, as for instance from floor to wall set, the cable is exposed to mechanical injury and moisture, when the floor is scrubbed, and should always be protected by iron conduit or wood moulding. Lead cable for use inside in fireproof buildings should be run in iron conduit.

When wires are brought outside to connect two separate buildings the lead covered cable should either be supported between the buildings by a messenger wire, Fig. 4, or run underground through conduit. When messenger wire is used, it should be securely anchored to each building. If the run is of any length it should be carefully grounded for protection against lightning, particularly when metal cable hangers are used for holding the cable to the wire. The cable should be bent to form a drip loop just before entering the building, so that rain water will drop off at this point and not follow the cable inside. If the cable is run underground through a pipe, there must be no rough edges on the pipe, as these would be likely to damage the cable sheath when the cable is drawn in.

The cable terminals and connecting blocks shown in connections with Fig. 2 and 3 are designed for use where a junction is to be formed between two, three or four cables as, for example, where an outside lead covered cable is to be connected with an interior cable or wherever a branch is to be taken off the main cable. They should be located in an accessible place, but not exposed to mechanical injury, dampness or excessive vibration. Not over four cables should ever be connected to these cable terminals or connection blocks, as too many wires fastened to a terminal make the connections unreliable.

In the next article instructions will be given for preparing the cable for connection to the terminal or connecting blocks.

WHAT WESTERN INVENTORS ARE DOING

BY WM. K. WHITE AND H. G. PROST

(It is not always possible to establish priority claims after many years and failure to apply promptly for a patent on new devices and machinery may bring the electrical manufacturer into the position of being held for infringement of an invention which was made by himself. The protection offered by the Patent Office is the easiest and cheapest form of insurance and a necessity in the life of every manufacturing company. The possible contingencies and their forestalling are here discussed by prominent patent attorneys of San Francisco.—The Editor.)

NOTES ON PATENTS

The term or life of a United States patent is seventeen years, commencing on the date of issuance of the patent. On January 1, 1918, the United States had issued 1,251,547 patents, of which 586,721 were then unexpired. Patents now are issuing at the rate of 40,000 a year, and this rate is constantly on the increase.

The state of California is well to the front in respect to the number of patents issued to its residents in proportion to its population. In the year 1916, California residents received patents in the ratio of 1 patent to every 1,122 of the state's population. In the same year the New York ratio was 1 to 1,302; the Pennsylvania ratio was 1 to 1,985, and the Mississippi ratio was 1 to 16,190. These figures entitle California to lay claim to being a land of invention as well as a land of sunshine, fruit and flowers.

The value of patents is fully recognized by the largest manufacturing concerns of the country, and many of them maintain elaborately equipped experimental and research laboratories and patent departments for the development and protection of new inventions.

To keep abreast of the progress being made in its particular line of industry, it is customary for such a concern to secure, as soon as issued, all patents pertaining to such industry.

Infant industries receive more protection from patents than they do from high tariffs and to such patent protection is due the present wealth and prosperity of some of the greatest manufacturing organizations of the country.

To the manufacturer, the value of patent protection is twofold. After expending thousands, and sometimes hundreds of thousands of dollars, in developing some new type of machine or apparatus, it is absolutely essential for him to secure patent protection thereon in order to enable him to obtain an adequate return on his original investment in such experimental work. Without such protection, he would be compelled to immediately meet the competition of others who, unburdened by the expense of developing the machine, could duplicate it and sell it at a price sufficient to yield them an ordinary profit, but insufficient to yield the developer thereof any return on his development expenditures.

From the manufacturer's standpoint, patents are also a species of insurance against possible litigation. When the manufacture of any new or modified form of machine or device is commenced, it is most important for the manufacturer thereof to carefully consider the possibility of securing patent protection therefor, even though, in his opinion, the exclusive right of making the machine may be of little value to him. If he fails to file an application for a patent on such new machine or device he may be confronted with the following and not uncommon situation:

Years after commencing the sale thereof, he is notified that the machine infringes a patent applied for months and possibly a year or more after he first placed the machine on the market. The application for such patent may have been pending in the Patent Office for a number of years and under the law, the validity of the patent is not affected by anything done by the manufacturer after the filing date of the application. To prove that he was the first to make the patented machine, the manufacturer is compelled to prove what he did in that regard prior to the application filing date. If said date be five or six years prior to the time his attention is first called to the patent, the difficulty of making such proof is apparent. The drawings and patterns, used in making his first type of machine, may have been lost; the manufacturer may not be able to locate any of the first machines sold by him and his later machine may differ therefrom in form if not in principle. He is, therefore, confronted with the necessity of basing his proofs on the oral testimony of witnesses attempting to remember the details of construction of a type of machine made years before, and such character of proof is always deemed unsatisfactory and of little weight. The manufacturer, therefore, may be held an infringer of a patent covering a machine which was, in fact, first developed by himself, but which fact he is unable to prove by sufficient evidence.

The foregoing and not unusual predicament could have been avoided by the manufacturer, if he had filed an application for a patent on his machine as soon as the same was perfected.

Such an application would be record evidence of his activities and, in the event of another party filing an application disclosing a similar machine, an interference would be declared by the Patent Office between the applications, and the question of priority of invention be at once determined and the patent be issued to the first inventor. Furthermore, the necessity of proving, in such interference proceeding, that he was the first one to invent the machine, would usually arise very soon after the manufacture and sale of his first machine and, therefore, the manufacturer then would be in a position to produce sufficient proofs of that fact, which, many years thereafter, might not be available to him.

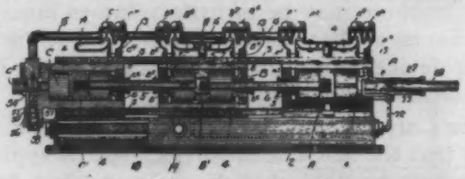
In view of the foregoing, the manufacturer of any new or modified type of machine or device should look

upon the filing of an application for a patent thereon as a form of insurance against infringement suits, and very cheap insurance at that.

NEW IDEAS FROM THE WEST

Pressure Transformer

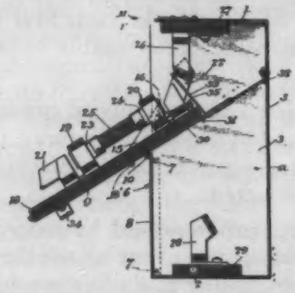
Patent No. 1,253,718, issued to George A. Peterson of Oakland, California, discloses a novel form of apparatus for transforming hydraulic pressure. The apparatus consists of a plurality of aligned cylinders rigidly secured together. Disposed in each cylinder is a piston and the pistons are all rigidly connected together by a piston rod extending through all of the cylinders. Each cylinder end is provided with an



inlet pipe and an exhaust pipe and valves are provided for controlling the inlet and outflow of water from the two cylinder ends. The valves are operated successively by cams secured to a rotatable cam shaft. Water from a tank or water main is introduced into one end of the cylinders and the water discharged from the other end is conducted to the press or other device in which the pressure is desired. A gradually increasing pressure at the press is produced by successively increasing the number of cylinders into which the power water is fed and then gradually decreasing the number of cylinders from which the pressure water is taken. At the beginning of the operation power water is introduced into one cylinder and pressure water taken from all of the others, resulting in low pressure water, and at the end of the operation power water is introduced into corresponding ends of all of the cylinders and the pressure water is taken from one cylinder only, the pressure ends of the other cylinders being open. This produces water under high pressure.

Circuit Breaker

Patent No. 1,253,761, issued to Richard Wolfsberg and Sidney C. Smith of Los Angeles, California, shows a safety circuit breaker. The circuit breaker consists of a case having contacts therein at the top and bottom and a door hinged intermediate, its ends to the front wall of the case at about



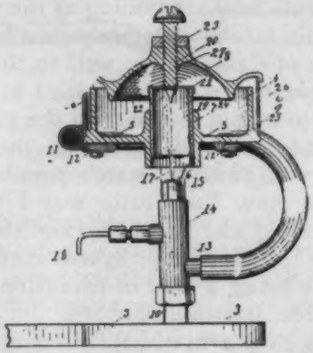
the vertical center of the front wall. The door carries contacts on its inside surface, which engage the contacts in the case and close the circuit when the door is closed. When the door is pulled open the circuit is broken. Means are provided for holding the door in a slanting position when it is open, and secured to the inner end of the door is a shield which contacts with the rear of the case, closing the bottom portion of the case.

Indicator Reversing Means

Patent No. 1,253,388, issued to Orlando E. Kellum and Arthur H. Sweetland of Los Angeles, California, shows an indicator reversing mechanism for street cars. The indicator reversing mechanism includes an electro-magnetic field magnet and a bi-polar armature. Mechanical means are provided for normally holding the armature with either of its poles initially inclined toward one of the field magnet poles, and electro-magnetic means are provided for operating the mechanical means, to shift the armature from one normal position to the other. Cooperating with the electro-magnetic means is a mechanism which operates to cause a single operation of the indicator-actuating mechanism when the armature is shifted from one position to the other, and this mechanism includes a switch which is closed by the movement of the mechanical means and opened by a movement of the armature.

Regulator for Oil-Gas Burners

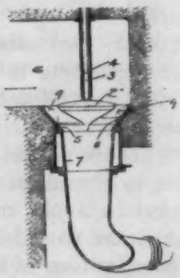
Patent No. 1,253,578, issued to Charles E. Crane of Seattle, Washington, shows a regulator for oil-gas burners. The regulator consists of a mixing chamber having a vertical centrally disposed intake tube and a cylindrical outer wall. Surrounding and spaced from the outer wall is a perforated cylindrical wall which forms the burner, and this burner extends above the cylindrical outer wall. Secured to the outer wall is a dome-shaped cap which deflects the oil downwardly



into the mixing chamber, after it enters through the tube. The oil is sprayed through the tube from a nozzle and the tube is formed telescopically, so that the distance between the upper end thereof and the cap can be adjusted, to vary the amount of air entering the mixing chamber with the oil spray.

Hydraulic Valve

Patent No. 1,253,013, issued to William A. Doble of San Francisco, California, and assigned to the Pelton Water Wheel Company of San Francisco, discloses a novel form of needle valve for controlling the flow of water. Much difficulty has been experienced in valves of this nature due to the intense vibration of the valve when it is moved to a position adjacent the valve seat. The flow of water past the valve pro-



duced vibrations in the valve structure which resulted in the fracture of the valve stem, even when the stem was made excessively large. The object of the present invention is to prevent the vibration of the valve, and this is accomplished by providing means for causing the water to exert unequal pressures on the valve in a direction transverse to its line of movement.

The means employed consists of a semi-cylindrical wall of less height than the stroke of the valve, which springs upward directly from the valve seat. In its initial unseating and final seating movements, the valve is in sliding contact with the wall, so that water flows past the valve on one side only.

SPARKS—Current Facts, Figures and Fancy

(Stimulating the traffic on a city street car system by a lottery on fare receipts is a strictly South American system. In Japan they encourage the electrical industry by a trade exhibit. According to recent reports on the telephone situation, the United States needs no added impetus, for it possesses more than twice as many telephones as all of Europe put together, besides capturing another world's record in the recent boring of the deepest well yet sunk.—The Editor.)

Europe had four million odd telephones and the United States something over eleven millions at the close of 1917. All of Asia is reported as having 340,000 and Africa about 66,000. North America alone, indeed, contains nearly three-fourths of all the telephones in the world.

* * *

Flood lighting a fire seems hardly necessary, but this method was used to help the firemen fight the flames in the recent conflagration at an electric company's plant in New York state. The flood lighting was an improvised affair by the company employees, but materially aided the fire fighters in their work.

* * *

Pay as you enter and you may win a $150 prize in the lottery as run by the street car system of Lima, Peru. Numbered paper slips are given in exchange for the fare, and these are equivalent to tickets in the semi-monthly drawing conducted by the street car company. The scheme is intended to encourage riding on the street cars.

* * *

Conservation of telephone calls is the most recent article on the "hooverized" list. A Fort Wayne telephone company has asked the public to eliminate all unnecessary calls and to shorten social "visiting," as a war measure, in order that the increased business calls of war times may be handled by a force crippled by shortages of labor and materials.

* * *

Trouble from leaving the telephones in circuit on a patrol line has been obviated by a Western power company by a simple arrangement by which the telephone is automatically disconnected with the closing of the cabinet door. A "baby" knife switch mounted on the inside of the cabinet is struck by a wooden lug fastened to the door—and the telephone thus cut off.

* * *

A novel method of economizing on deliveries has been worked out by a Kansas grocery store which lends customers a small wagon for hauling home purchases too bulky to be carried. These are home-made from scrap lumber and canned goods boxes and cost about 25 cents. The novelty of the idea seems to please the customers, who enjoy trundling home their express wagons.

* * *

We may yet set our clocks an hour ahead for the summer months. The Daylight Saving Bill has already passed the Senate and has been favorably reported to the House. The bill is being advocated as saving electricity as well as daylight. It has been estimated that fifteen million tons of coal now used for lighting through gas and electricity would be saved through this plan.

The deepest well in the world, already 7,363 feet deep, is now being drilled near Clarksburg, in northern West Virginia, in search of deeper oil sands than have yet been reached in this part of the country. This is already 13 feet deeper than the previous record, which had been held by a boring in Silesia. This well goes half a mile deeper into the earth than the Grand Canyon, and the drilling is still in progress.

* * *

An exhibition of electrical machinery and appliances will be opened at Tokio on March 20, 1918, under the auspices of the Nippon Denki Kyokwai (Japanese Electric Association). The manuufacture of electrical machinery and appliances in Japan has undergone great development during recent years, and the object of this exhibition is to show the progress that has taken place, and to give a stimulus to further enterprises. Only Japanese manufactures will be shown.

* * *

It is reported that the French army has recently introduced a novel form of miniature searchlight operated by electricity and equipped with a telescope. When in use the searchlight is held in the hands of the operator, so as to bring the telescope into sighting position. The searchlight is aimed at the aircraft with which communication is to be established and maintained, and the operator then sends the messages by means of a tapping key on the side, causing long and short flashes of light to spell out the words or numerals in the telegraph code used.

* * *

An ingeniously constructed small electric mouth light for use by dentists, together with a potential reducer for use with it so that the light can be connected to any lighting socket of 110 volt alternating or direct current, is now offered the trade. The light and the ordinary type of mirror used by dentists is combined in such a way that it can be used in the same manner that the mirror is ordinarily employed.

* * *

"Clipping" of gold coins is now done by electrolysis, the government has discovered — and they have invented an electric machine to detect the light coins thus produced by way of compensation. In the coin detector the coins are pushed in succession from the balance pan on to a knife edge, and according as this knife edge is at the right-hand limit of its range or the left-hand limit, the coin, when pushed on it, tilts to the "light" channel or to the "full weight" channel, as the case may be. The right or left position of this shifting knife edge is determined by an electric contact made by the balance beam, and thus an electromagnet is brought into action.

PERSONALS

W. W. Briggs, formerly general agent for the Great Western Power Company, has left San Francisco for New York City, where he has accepted an executive position with the Westinghouse Lamp Company. Before leaving San Francisco, a beautiful luncheon was tendered Mr. Briggs at the San Francisco Engineers' Club on Thursday, February 28, 1918. Mr. Briggs has long been an active and energetic member of the club which he has served as its president in past years. In the impromptu remarks that followed the luncheon, emphatic expression was given by various engineers of the Bay Region to Mr. Briggs' effective work in the West and the hope expressed that his departure to the East may prove but temporary.

Dr. Robert C. Coltman, an official of the Standard Oil at Peking, is a recent San Francisco visitor.

Harvey Boomer, manager of the Jobbers Supply Company, Minneapolis, called on electrical men at Seattle recently.

W. A. Thompson, of the Federal Sign System (Electric) has returned to San Francisco after a successful month's business trip to Arizona.

C. W. Chestnut, sales manager Western Electric Company, Seattle, recently spent a week looking after business on the Olympic peninsula.

Howard R. Sargent, managing engineer of the wiring supplies department of the General Electric Company, is a recent San Francisco visitor.

A. G. A. Van Elde, a consulting engineer from Amsterdam, passed through San Francisco recently on his way to Java to develop water power sites.

W. S. Rugg, manager of the railway department of the Westinghouse Electric & Manufacturing Company at East Pitsburgh, is a San Francisco visitor.

Chas. A. Watts, formerly with D. Dorward, Jr., consulting engineer, has established an office as mechanical engineer at 24 California street, San Francisco.

H. R. Stevens, of Stevens & Rockwell, consulting electrical engineers, Seattle, has been made electrical engineer for Stone & Webster for the Northwest district.

Harry Byrne, manager of the North Coast Electric Company, Seattle, has returned from a ten-day business trip, visiting New York and other cities while away.

Tracy Bibbins, president of the Pacific States Electric Company, has returned to San Francisco after a hurry trip to Schenectady, N. Y., and other Eastern points.

Samuel Insull, president of the Commonwealth Edison Company of Chicago, a well-known national figure in utility life, is expected in San Francisco March 21, 1918.

Herbert J. Baker, who until recently was manufacturer's agent for electrical equipment in Denver, is now electrical and mechanical engineer for the Evergreen Mines Co., at Apex, Colo.

Lyle G. Fear, sales engineer with the Westinghouse Electric & Manufacturing Company at Portland, has been elected an associate member of the American Institute of Electrical Engineers.

J. R. Tomlinson of Portland has received the appointment as a member of the National Chamber of Commerce representing the National Association of Electrical Contractors and Dealers.

Daniel Gallick, of the publishing staff of the Journal of Electricity, is the latest contribution of the Journal of Electricity to the national service. Mr. Gallick is with the 319th Engineers at Camp Fremont.

H. D. Carr, designer with the Braden Copper Company, Rancagua, Chile, and **Y. Nakamura** of Yamaguchi-ken, Japan, are two new Pacific associate members of the American Institute of Electrical Engineers.

F. B. Caswell and **R. A. Stranahan**, executives of the Chicago, Milwaukee & St. Paul Railroad, are recent San Francisco visitors. The Milwaukee road is the first to electrify its lines over the continental mountain passes.

George I. Plummer recently resigned as superintendent of transportation of the Dallas Railway Company of Dallas, Texas, and has enlisted in the supply department of the United States Army, being located at San Diego, Cal.

B. A. Plimpton, sales manager of the Locke Insulator Manufacturing Company, Rochester, N. Y., is a recent San Francisco visitor, and **Walter Goddard**, electrical engineer for the company, is expected in this city at an early date.

J. R. Lowe, formerly assistant engineer of the Pacific Electric Railway Company of Los Angeles, Cal., has been appointed superintendent and assistant chief engineer of the San Diego & Arizona Railway, with headquarters at San Diego, Cal.

W. C. Davidson, treasurer of the Spokane & Inland Empire Railroad, the United Railways, The Oregon Electric Railway of Portland, Ore., and affiliated lines, will hereafter act as tax agent, and all tax matters of the company will be under his jurisdiction.

E. E. Nash, of the Peerless Electric Company and the Peerless Lamp Company, will arrive in San Francisco Wednesday, after having spent several weeks in Los Angeles. Mr. Nash is on an extended business trip in connection with the interests of his companies.

Professor O. F. Stafford, head of the department of chemistry at the University of Oregon, recently gave a talk on "The Possibilities and Impossibilities of Electrical Application to Chemical and Metallurgical Industries of Oregon" before the City Club at Portland.

H. C. Henry, who was named on the committee of the United States Chamber of Commerce to frame legislation with Congress to unlock the vast water possibilities of the nation, was in San Francisco recently on his way home. He said that it seemed assured that Congress would act at this session.

W. F. Durand, professor of mechanical engineering at Leland Stanford Junior University, has arrived safely in France, after a voyage of 18 days, according to word recently received by his friends at Palo Alto. For years Professor Durand's work as head of the mechanical engineering department at Stanford has proven most effective in training young men for technical careers, and now his service to the government as head of the United States Aeronautical Board is effectively helping to give to the nation at large a weapon to blind the eyes of the enemy in the coming months that will undoubtedly prove one of the determining factors in demonstrating the superiority of American genius in its fight for democracy and the freedom of small nations. The arrival in England is announced of delegates from all the allied countries for conference on international standards, at which a standardization of manufacturing materials as related to the production of machinery, motors and aircraft, will be considered. Among the list of distinguished Americans to attend this conference appears the name of W. F. Durand.

E. C. Jones, for many years chief gas engineer for the Pacific Gas & Electric Company, has recently had his duties vastly enlarged. In his extended duties, Mr. Jones has full authority over the gas department in all its branches. Mr. Jones has long been an eminent authority in gas manufacture, and his broadened responsibilities insures increased economy as well as increased efficiency in operation. All well wishers of the West take unusual interest in the continued progress of Mr. Jones, due to his ever having shown such a beautiful spirit of helpfulness to others as witnessed by his lectures on gas engineering before the students at the University of California and in countless other ways.

A. E. Garland of the Garland-Affolter Engineering Company, is leaving for Los Angeles this week.

Leon B. Jones, the son and able assistant of the chief gas engineer, has recently returned from Washington, where he has rendered valuable assistance to the government upon the subject of tuluol.

Max Loewenthal, of the Panama Lamp & Commercial Co., San Francisco, has returned from an extended trip through the Northwestern and Inter-mountain territory in the interest of his firm and reports a growing demand for electrical home appliances.

W. C. Swisher, supervisor of safety of the Denver Tramway Company of Denver, Colo., has left this company to take up the position of general claims attorney for the Kansas City Railways Company of Kansas City, Mo. Mr. Swisher entered the employ of the Denver Tramway Company in June, 1910.

Terrell Croft, the well-known electrical engineer and author of many books on electrical engineering, has joined the Luminous Unit Company of St. Louis, Mo., as its chief electrical engineer. This company is to be congratulated on securing the services of so able an engineer as Mr. Croft.

H. A. Lemmon, sales manager of the Truckee River General Electric Company at Reno, has been made food administrator of Nevada, succeeding Henry M. Hoyt, resigned on account of illness. Mr. Lemmon is secretary of the State Council of Defense. He will give his entire time as a volunteer to war work.

E. F. Bauer of Anchorage, resident engineer of the Alaska Railway Commission, is visiting in Seattle. This is the first time in three years he has been out from the interior. At a luncheon given Mr. Bauer at the Engineers' Club he said that he had sent in his application for a position on Colonel Mears' Engineer Corps and hoped to be called East any time.

J. C. Daries, right-of-way and tax agent of the Oregon Electric Railway Company, the United Railways Company and the Spokane & Inland Empire Railroad Company, of Portland, Ore., has been relieved of his duties as tax agent, but will perform, in addition to his duties as right-of-way agent, the duties of sales manager of the Ruth Realty Company.

E. P. Morphy, treasurer and assistant secretary of the Southern California Telephone Company, Los Angeles, Cal., has severed his connection with that company and is now comptroller of the Los Angeles Shipbuilding & Drydock Company at San Pedro, Cal. Mr. Morphy was formerly secretary and auditor of the Home Telephone & Telegraph Company of Los Angeles.

Alexander McAdie, formerly for years head of the Pacific Coast Division of the U. S. Weather Bureau at San Francisco, and well known to men of the electrical industry in this section, has been made lieutenant commander of the United States Navy in charge of naval aeronautics. In recent years Mr. McAdie has been professor of meteorology at Harvard University, where he has rendered distinguished scientific service.

Charles H. Lee, formerly consulting civil and hydraulic engineer of Los Angeles, is now a first lieutenant in a water supply regiment of the American Expeditionary Force in France. His address is: First Lieut. Chas H. Lee, Engrs., U. S. R., care Chief Engineer Officer, Water Supply Section, A. E. F., Military P. O. 706, France.

Harris J. Ryan, professor of electrical engineering at Stanford University, is busily engaged in investigating the controlling factors in the durability of suspension-type insulators. This research effort, which is of such timely value in the West, has involved much routine work, the handling of large amounts of material, and the making of many observations. Much good is anticipated by men of the electrical industry from this excellent investigation.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, is at Washington, D. C., where he has gone to present data before the governmental authorities showing the necessity for immediate action looking toward unlocking the great water power resources of the nation. While in Washington, Mr. Britton, as head of the local Red Cross, will confer with national leaders in regard to the new big Red Cross drive set for the month of May.

Loyall A. Osborne of New York, vice president of the Westinghouse Electric & Manufacturing Company and chairman of the executive committee of the National Industrial Conference Board, has been appointed by the Secretary of Labor a member of a committe on industrial peace during the war. This committee, which consists of five representatives of employers, five labor leaders and two public men, will provide a definite labor program in order that there may be industrial peace during the war, thus preventing interruption of industrial production vital to the war.

Chas. T. Phillips, consulting engineer, San Francisco, gave an interesting and instructive talk recently before a convention of municipal officials at Santa Rosa, on the subject of scientific street lighting. Mr. Phillips stated that too much dependence was placed upon what had been done in the past and not enough consideration was given to what could be done by modern methods and appliances. The cities on the Pacific Coast should lead the country in street lighting because the cost of electrical energy is low and the West is the pioneer in the use of electricity on a large scale.

E. B. Walthall, assistant general manager of the San Joaquin Light & Power Company, is busily engaged in these pre-convention days, in contributing his bit to the excellent paper on retail merchandising to be presented at the Del Monte convention of the Pacific Coast Section, N. E. L. A. The commercial section recently held a meeting at Mr. Walthall's home city, Fresno. No one knows where he got his inspiration for his effective work at that time except a representative of the Journal of Electricity, who snapped Mr. Walthall's picture, which shows Mr. Walthall standing to the right in the view, inhaling inspiration from the famous lines of "Hot Stuff Alley," so-named because bordering the narrow roadway exhibited are 3 telephone circuits, 1 eleven thousand, 2 thirty thousand and 2 sixty thousand volt lines of the San Joaquin Light & Power Company.

The all-enticing golf links—the safety valve for pent-up enthusiasm at the forthcoming convention

THE WAR SERVICE CONVENTION AT DEL MONTE

All is in readiness for the Del Monte convention, Pacific Coast Section N. E. L. A., April 24-27. The four days and nights will be crowded with business, with just enough relaxation to relieve the mind. For this is to be a war-time convention, grappling with the serious problems that now confront the electrical industry. Every paper has been prepared with this end in view and the views of every man are wanted in discussing the solutions proposed.

As this is to be the one big meeting of the year in the West, a record-breaking attendance is anticipated. The California Association of Electrical Contractors and Dealers will hold their annual convention the day before the Pacific Coast Section N. E. L. A. and will then attend the sessions of the latter. The Pacific Coast Electrical Supply Jobbers' Association will likewise hold a prior meeting and then participate in the end-of-the-week activities. The California Association of Electrical Inspectors will also meet at the same time and place. Representatives are to be present from the Northwest and from the East. Everybody who is anybody will be there.

President H. F. Jackson has appointed able committees, who have been hard at work for three months completing all arrangements. Del Monte was selected as the meeting place because of its accessibility, freedom from distraction and the excellent accommodations afforded. Special railroad and hotel rates will be in force.

As these forms go to press a final meeting of the executive committee is being held at Los Angeles on March 15 to approve all plans and papers. Pending their action certain tentative announcements can be made at this time. All papers will be published in the April 1st and 15th issues of the Journal of Electricity and thus allow ample time for preparation of discussion on the part of members of the association and obviate the reading of papers at the meeting.

Commercial Committee

Chairman R. M. Alvord called a meeting of this committee at Fresno, California, March 1st to pass on all papers. Only five papers will be presented, but these deal definitely with the most important present features of the electrical business in the West.

A sub-committee consisting of G. B. MeLean, W. L. Berry, C. M. Einhart, H. J. Kister and Miles F. Steel have prepared a paper entitled "Bricks Without Straw," the getting of business without costly extensions, which discusses ways and means for increasing business on existing lines.

"Retail Selling Practice" is the title of an exhaustive paper written by L. H. Newbert, H. L. Aller, H. A. Lemmon, M. L. Scobey and E. B. Criddle. This is a selling manual for the use of central stations or dealers operating retail stores. It goes into every detail of electrical merchandising, including sales arguments, store and window display, and advertising. It will be supplemented by moving pictures showing approved selling methods.

"Industrial Heating" is the subject of a paper by A. E. Holloway, J. B. Black and C. B. Walthal, to be published but not discussed.

A paper is to be presented from the dealers' side by a committee from the California Association of Electrical Contractors and Dealers and from the jobbers' standpoint by the Pacific Coast Electrical Supply Jobbers' Association.

Engineering Committee

Chairman J. E. Woolbridge held meetings of his committee at San Francisco and Los Angeles on March 4th and 5th, when all papers and reports were reviewed. The committee report will summarize the work of the past year as given in more detail in the papers and sub-committee reports.

Fred H. Fowler, electrical engineer for the Forest Service at San Francisco, will analyze proposed hydro-electric developments increasing the power supply. This will be concerned w'th stream flow data in the Sierra Nevada Mountains, Arizona and New Mexico. It will be illustrated by lantern slides. H. A. Barre will present a complementary paper on "Conservation of Power Resources in Southern California."

J. P. Jollyman will read a paper on "Interconnection of Transmission Systems," discussing the subject both technically and practically.

"Increasing the Efficiency of Steam and Hydro Plants" is a report summarizing the answers to questionnaire calling for a searching examination of existing plants. This includes a paper by E. C. Hutchinson on "Waterwheels," one by R. J. C. Wood on "Power Plant Losses" and one by R. E. Cunningham on "Losses in a Transmission and Distribution System."

R. C. Powell has an excellent paper on "Iron and Steel Conductors," which is by far the most useful that has yet been written on this subject.

"Standardization of Pin Type Insulators," "Substitutes for Cedar Poles" and "Insulator Tests" are the subjects of sub-committee reports.

Enchanting scenery on all sides at Del Monte

Accounting Committee

Chairman C. P. Staal and the other members of his committee have valuable suggestions for the revision of accounting practice of public utilities. This report will be presented immediately after the opening session on Wednesday afternoon.

Public Policy Committee

This report will trace the legislative and judicial developments of the past year and outline approved procedure to meet the pressing problems of these strenuous times.

Membership Committee

Under the direction of W. L. McKinley this committee is active in increasing the membership of the association. It has been especially successful in securing large Class D representation.

Convention Committee

General Chairman Robert Sibley has divided up the work of convention detail by assigning definite responsibilities to each committeeman, who in turn is to act as chairman of a committee to handle the work assigned. These appointments are as follows:

1. Entertainment, R. E. Fisher.
2. Reception, R. F. Behan.
3. Program, J. W. Redpath.
4. Finance, M. A. DeLew.
5. Banquet, T. E. Bibbins.
6. Out-of-Door Sports, W. S. Berry.
7. Registration and Attendance, H. P. Pitts.
8. Automobile, H. C. Reid.
9. Transportation and Hotel, W. M. Deming.

A. B. West, E. R. Northmore, W. L. Frost and H. H. Jones, the Southern California representatives on the committee, are working in harmony with the general scheme outlined above, but serving with especial reference to convention committe activities in Southern California. A convention committee meeting was held in Los Angeles Wednesday, March 13th, at which time complete organization was effected.

Besides the working out of a masterful scheme of transportation and hotel accommodations under the direction of W. M. Deming, by means of which much of the confusion and loss of time occasioned at previous gatherings will be avoided, the committee has in the planning a series of entertainment feats and get-togethers that will make this occasion for the men and women who attend one long to be remembered in the annals of the West, now so famous as a place where man-to-man-fellowship is enjoyed to such a high degree.

Quiet walks for "twos-ing" parties

MEETING NOTICES FOR ELECTRICAL MEN

(A joint meeting of the engineering societies of the bay region for the purpose of hearing Professor Swain, an important session of the California Co-operative Merchandising Committee at Fresno, and various meetings looking toward the N. E. L. A. convention in April, are among the recent gatherings. Reports of interesting programs come from all sections of the country.—The Editor.)

Joint Meeting of San Francisco Societies

A joint meeting of the local sections of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers, and the American Chemical Society, will be held at the Palace Hotel, on Wednesday, March 20, 1918, in honor of Professor George F. Swain, past president of the American Society of Civil Engineers and professor of civil engineering in the Graduate School of Engineering at Harvard and Massachusetts Institute of Technology. An informal dinner will be served at 6:30 p. m. Dr. Benjamin Ide Wheeler, president University of California, will introduce Professor Swain, who brings a message from the East on "National Issues of Today." Other noted engineers will be present as guests.

Alameda County Electrical Club

The Alameda County Electrical Club will hold its regular monthly meeting in the Commercial Club rooms on the top floor of the Hotel Oakland, on March 21, at 12:15 p. m.

Walter Martinez has been appointed chairman of the meeting by President George Drew, and will have Lieutenant R. B. MacPherson of the Radio School of Aeronautics of the University of California, as the principal speaker. Captain Jackson of the National Electric Light Association will also give a short talk.

Great preparations are being made for the largest crowd of the year, and it is hoped that the electrical men from both sides of the bay will be in attendance.

Oregon Society of Engineers

Plans for a club house for the Oregon Society of Engineers were formulated by a committee appointed at a meeting of the organization held recently. Other engineering societies will be invited to merge with this society in the building and use of the club rooms.

Another important measure decided upon at the meeting was the framing of an amendment to the constitution which will allow the formation of chapters in small cities of Oregon. The amendment is to be voted upon at the next meeting of the organization. At present the society is established in Portland, but engineers from all parts of the state are eligible to membership.

The co-operation of other engineer organizations of the city will be sought in an effort to establish an employment bureau for men engaged in the engineering profession.

California Electrical Co-operative Campaign

The advisory committee handling this campaign met in Fresno on Thursday, February 28, there being present:

L. H. Newbert, manager Commercial Department, Pacific Gas & Electric Company, San Francisco, chairman of the committee.

G. E. Arbogast, Southern California Edison Company, Los Angeles, Cal., vice-chairman.

G. B. McLean, Southern California Edison Company, Los Angeles, Cal.

A. E. Wishon, assistant general manager San Joaquin Light & Power Company, Fresno, Cal.

R. M. Alvord, manager supply department, General Electric Company, San Francisco, Cal.

D. E. Harris, sales manager Pacific States Electric Company, San Francisco, Cal.

H. C. Reid, President California Association of Electrical Contractors and Dealers, San Francisco. Pacific Fire Extinguisher Co.

J. W. Redpath, secretary.

E. B. Walthall, sales manager San Joaquin Light & Power Corporation.

Mr. A. L. Spring, field man carrying on the work in the southern section of California, was also present.

The selection of a suitable trademark for the California Association of Electrical Contractors and Dealers was postponed until after the 15th of March, to give several artists time to complete their proposed designs. Preliminary reports presented indicate that the committee will have several designs from which to select. This contest for prizes aggregating $100 is open to all and the committee would be very glad to have additional trademark suggestions sent to Trademark Editor, California Electrical Co-operative Campaign, 505 Rialto Building, San Francisco, Cal.

Full details of the contest were published in the February 1st issue of the Journal of Electricity.

Mr. W. F. Brainard was employed by the committee to act as field man, and will soon take up the work in the central and section of the state. Mr. Brainard has had considerable selling and merchandising experience, and it is expected that he will assist materially in securing the results toward which the committee is working.

The support of the committee's work by all men interested in the electrical industry is particularly desired, and to this end the committee proposes to conduct a publicity or educational campaign outlining the objects to be accomplished and the work which the committee proposes to do. A special meeting for this purpose is planned in connection with the work of Mr. Spring, in Los Angeles.

In addition to generally reviewing the excellent report of conditions in the South, as presented by Mr. Spring, and discussing with him the need of further activity, the committee outlined at the Fresno meeting a plan for holding a general get-together meeting of all men in the electrical industry in and around Los Angeles. It is expected to hold this meeting about March 15th, one of the principal speakers to be Mr. Albert Elliot. It is hoped that this meeting will be attended not only by contractors, dealers, jobbers, manufacturers and central station officials, but also by the employees of these different organizations, particularly the commercial employees.

BUILDERS OF THE WEST—XXV

O. B. COLDWELL

The commonwealths of the Northwest have contributed many distinguished educators, executives and engineers to the upbuilding of the West as a whole. In and about Portland, Oregon, there has grown a system of railway, light and power effort that for efficiency and courtesy has established new records in utility service to the public. To O. B. Coldwell, superintendent of the Portland Railway, Light & Power Company, this issue of the Journal of Electricity is affectionately dedicated. And in this dedication account is not only taken of the eminent engineeering and executive ability he has displayed, but also for the wealth of good cheer he gives out to all with whom he comes in contact.

San Francisco Engineers' Club

The San Francisco Engineers' Club continues to have lunches and get-togethers that are becoming distinct traditions in the engineering life of the San Francisco Bay region. The local branches of A. S. C. E. and A. S. M. E. hold individual weekly luncheons at the club rooms, as do a number of other local technical organizations. The lunch price is but 60 cents and the service is excellent. On March 12, 1918, Dr. Ludwik Ehrlich, lecturer in political science at the University of California, gave an interesting talk on "America's Peril in Light of Prussian and German History."

The San Francisco Electrical Development League

President R. E. Fisher's initial meeting of the League on March 6, 1918, started off with a zest and enthusiasm that portends much for the future usefulness of this organization in affairs electrical of the San Francisco Bay region.

Amid the Aztec yell for the forthcoming convention of the Pacific Coast Section N. E. L. A., the meeting was called to order. The yell is as follows:

Escalaventa
Escalaventa
Dorienta
Dorienta
Umfada
Umfadade
Umfadade
Del Monte-ul-la-la.

The portion to the right is led by the yell leader, while that to the left is repeated in unison by those giving the yell.

Tracy Simpson, veteran manager of the Federal Sign System (Electric) was then introduced and gave a sketch of the life and work of Nathan A. Bowers, a fellow member and the Western editor of McGraw-Hill Company. The talk proved a scream from start to finish. M. L. Scobey then read a most helpful paper on the jobber situation, which will be found in full on another page of this issue.

George Curtis of the Pacific States Electric Company, chairman of the membership committee, announced twenty-five new members, while F. E. Bayde of the General Electric Company, chairman of the entertainment committee, has in course of preparation a continuation of the series of helpful programs that have now become such well-established traditions of the League.

San Francisco Section A. S. E. E.

By far the largest and most enthusiastic meeting for the year of the San Francisco Section of the American Institute of Electrical Engineers was that held on the evening of February 28, 1918, at the rooms of the San Francisco Engineers Club. The meeting was bristling with interest due to the discussion of a very timely subject, namely, that of interconnection. The details of the program were announced in the last issue of the Journal of Electricity. On another page of this issue may be found the important features of the paper presented by Mr. P. M. Downing.

Pacific Coast Gas Association

The Pacific Coast Gas Association held its first get-together dinner of the present season at Los Angeels on the evening of Saturday, February 16th. One hundred and fifty-five representatives of the gas industry on the Pacific Coast sat down to an enjoyable feast in the banqueting room of the Hotel Alexandria. Naturally, the local men were most in evidence, but there was a goodly attendance from outside districts. San Francisco was represented among others by John D. Kuster, the association's president, Leon B. Jones, Van E. Britton, M. L. Neely and F. S. Myrtle. Two past presidents from the north attended, Messrs. Frank A. Cressy, Jr., of Modesto, and C. B. Babcock of San Francisco. Expressions of regret at unavoidable absence were received from Messrs. Jno. A. Britton, E. C. Jones and Harry Bostwick, G. P. Egleston of the Coast Counties Gas and Electric Company, and S. C. Bratton of the Portland Coke and Gas Company.

Non-Essential Industries in New York

"Non-Essential Industries—How They Can Help Win the War," was the subject discussed at the meeting of the New York Section of the American Society of Mechanical Engineers on Thursday, February 21st. Short, pointed talks by representative men covered such fields as "What Non-Essential Industries Have Done," "What Non-Essential Industries May Do," "What the Government Has Done," and "What the Government May Do." The object of the meeting was to direct the forces of non-essential industries toward winning the war, and non-members were invited to come and express their ideas.

Joint Meeting of Portland Sections of the A. I. E. E. and N. E. L. A.

The joint meeting of the local sections of the A. I. E. E. and N. E. L. A. was held Monday evening, March 4, 1918, at the Multnomah Hotel, Portland, Oregon.

The regular speaker, Mr. Thompson, assistant U. S. engineer in charge of the improvement of the Oregon City locks, was to have given a paper on this subject, but was taken very sick and could not appear. Consequently, it was necessary to arrange for another speaker to take his place, and Mr. Geo. C. Mason, president of the Hurley-Mason Company, offered to give a talk on the construction of Camp Lewis, Pierce county, Wash.

Mr. Mason said in part: "Camp Lewis is located 18 miles from Tacoma, Wash., on a hard-surfaced roadway. Also on the main line of the Northern Pacific Railroad. The site covers 70,000 acres of ground. Work was started July 10, 1917, and the cantonment was complete in eight weeks. Cost, $7,750,000. Consists of 2000 buildings, housing 54,000 men.

"It is the largest cantonment in the United States, and at times there were as high as 10,000 men employed. The pay roll per week was $383,000. Eleven miles of railroad tracks were built and 100 motor trucks used. Other material consisted of 60,000,000 feet of lumber, 871,200 feet of weatherproof wire, 1,300,000 feet of rubber covered wire, and 35,550 lamp sockets. All the buildings were built in units. During all the time of construction there was not one serious fire.

"Officers quarters are steam heated. The barracks are heated by hot air. There is installed complete sewer, water, fire protection, and lighting systems. The barracks are 180 feet long, housing 250 men in single bunks. The road system was constructed under separate contracts."

The Oregon Society of Engineers and the local section of the American Society of Civil Engineers were the guests of the Joint Sections (A. I. E. E. and N. E. L. A.). After the paper, light refreshments were served. The attendance was one hundred and twenty-five.

The next joint meeting of the Portland local societies of the A. I. E. E. and N. E. L. A. will be held on April 2, 1918. Mr. J. B. Fisher of Spokane, Wash., will be the speaker of the evening. The subject will be announced later.

April Convention of Utah Society of Electrical Contractors and Dealers

The complete program for the two-day convention of the Electrical Contractors and Dealers, which is to be held in Salt Lake City on April 5th and 6th, is not yet available.

However, some of the features embraced in the program will be a discussion of salesmanship with reference to electric articles, and papers on kindred subjects. On Friday evening, April 5th, a banquet will be given to members and visiting friends of the association. The program will also embrace motion pictures of lamp manufacturing and other electric appliances.

A very cordial invitation is extended to any and all who may be connected with the electrical industry, or who may be passing through en route to the Del Monte convention.

For any further information with reference to the convention, address the secretary, U. S. G. Todd, 604 McIntyre Building.

WHERE THE MEN OF THE INDUSTRY MEET

(The place where you can find where and when the other man meets. Information as to changes in officers, or additions or corrections, should be addressed to the Service Editor, Journal of Electricity. It is hoped to keep this directory up to date, so that travelers in a strange town who wish to attend the meetings of allied groups may not be misdirected.—The Editor.)

A. I. E. E.—WESTERN SECTIONS

National Officers
President—E. W. Rice, Jr., Engineering Society Bldg., New York City.
Secretary—F. L. Hutchinson, Engineering Society Bldg., New York City.
Meetings—Monthly.

Los Angeles Section
Chairman — Don. D. Morgan, 621 Pacific Electric Bldg.
Secretary—A. W. Nye, University of Southern California, Los Angeles, Cal.
Meetings—Second Tuesday of each month.

Portland Section
Chairman—S. D. Searing, care Portland Railway, Light & Power Co., Electric Bldg., Portland, Ore.
Secretary—R. M. Boykin, care North Coast Power Co., 441 Pittock Block, Portland, Ore.
Meetings—Monthly.
March 4 — E. B. Thompson, "Engineering Features of the Oregon City Locks."

Denver Section
Chairman — Norman Read, 828 Symes Bldg., Denver, Colo.
Secretary — Robt. B. Bonney, 603 Wyoming Bldg., Denver, Colo.
Meetings—Third Saturday of each month, from October to May, at the Denver Athletic Club. Dinner at 6:15 p. m., followed by regular meeting.

San Francisco Section—
Chairman—Lars R. Jorgensen, Chronicle Bldg., San Francisco.
Secretary—Allen G. Jones, Rialto Bldg., San Francisco.
Meetings — Fourth Friday each month—Engineers' Club, 7 p. m.

Seattle Section
Chairman — John Harisberger, 4015—4th Ave., N. E., Seattle, Wash.
Secretary — Glen Dunbar, City Lighting Department, Seattle, Wash.
Meetings—Monthly on third Tuesday in Chamber of Commerce Assembly Room, 9th floor, Arctic Bldg.

Spokane Section
Chairman—Charles A. Lund, W. 828 Providence, Spokane, Wash.
Secretary—J. E. E. Royer, W. 408 Cleveland, Spokane, Wash.
Meetings—Third Friday of each month.
March 15—"Lighting and Illumination."

Utah Section
Chairman—A. S. Peters, Mountain States Telephone & Telegraph Co., Salt Lake City, Utah.
Secretary—H. T. Plumb, 183 U St., Salt Lake City, Utah.

Vancouver Section
Chairman—R. F. Hayward, Western Canada Power Co., Ltd., Vancouver, B. C.
Secretary—T. H. Crosby, Canadian Westinghouse Co., Vancouver, B. C.

A. I. E. E.—WESTERN BRANCHES

University of California Branch
Chairman — A. J. Swank, University of California, Berkeley, Cal.
Secretary—G. F. Teale, University of California, Berkeley, Cal.

University of Colorado Branch
President—Robt. Newman, 1071—11th St., Boulder, Colo.
Secretary—William N. Gittings, 2422—12th St., Boulder, Colo.
Meetings—First and third Thursdays of each month of the school year in the Engineering Building, University Campus.

Idaho University Branch
Chairman—V. Pearson, Moscow, Idaho.
Secretary — L. J. Corbett, University of Idaho, Moscow, Idaho.
Meetings—First Wednesday evening of each month from October to June.

Oregon Agricultural College Branch
Chairman—J. A. Hooper, Oregon Agr. College, Corvallis, Ore.
Secretary—L. Happold, Oregon Agr. College, Corvallis, Ore.

Stanford University Branch
Chairman—H. W. Lewis, Stanford University, Cal.
Secretary—A. L. Morgan, Stanford University, Cal.

Montana State College Branch
Chairman—Roy C. Flagen, Montana State College, Bozeman, Mont.
Secretary—J. A. Thaler, Montana State College, Bozeman, Mont.
Meetings—Third Friday of every month of the school year in the Electrical Bldg.

Colorado State Agricultural College
Chairman—R. C. Richards.
Secretary—W. A. Stallings, Colorado State Agricultural College, Fort Collins, Colo.

Throop College of Technology Branch
Chairman—J. Paul Youtz, Throop Dormitory, Pasadena, Cal.
Secretary—Clark E. Baker, Throop Dormitory, Pasadena, Cal.

State College of Washington Branch
Chairman — S. E. Stites, 301 Montgomery St., Pullman, Wash.
Secretary—E. W. Tollefson, Box 393, College Sta., Pullman, Wash.
Meetings—Bimonthly at Mechanics Art Bldg., Pullman, Wash.

CONTRACTOR-DEALER ASSOCIATIONS

National Association of Electrical Contractors and Dealers
President—Col. Robley Stearnes, New Orleans, La.
Secretary — Harry C. Brown, 41 Martin Bldg., Utica, N. Y.
Directors — California: W. D. Kohlwey, San Francisco. Oregon: Samuel C. Jaggar, Portland.
Next Convention—Cleveland, July 17-20.

British Columbia Ass'n Electrical Contractors and Dealers
President—C. H. E. Williams, 509 Richards St., Vancouver, B. C.
Secretary—R. B. W. Pirie, 406 Yorkshire Bldg., Vancouver, B. C.
Meetings—First Tuesday of each month.

California Ass'n of Electrical Contractors and Dealers
President—H. C. Reid, 507 Montgomery St., San Francisco.
Secretary—J. W. Redpath, Rialto Bldg., San Francisco.
Meetings—Monthly.

Electrical Contractors and Dealers Ass'n of San Francisco
President—J. M. Carlson, 175 Jessie St., San Francisco.
Secretary—J. W. Asher, 601 Howard St., San Francisco.
Meetings — Saturday, 12:15; Hof Brau Cafe.

Southern California Electrical Contractors and Dealers
President—G. E. Arbogast, 724 So. Olive St., Los Angeles, Cal.
Secretary—J. E. Wilson, 425 Consolidated Realty Bldg., Los Angeles, Cal.
Meetings—Every Friday at 6:30 p. m. at the Pin Ton Cafe, 427 South Broadway.

Monterey Bay Electrical Contractors and Dealers
President—W. Cox, Santa Cruz.
Secretary—J. A. Noggle, Monterey.

Nevada Ass'n of Electrical Contractors and Dealers
President—F. V. McAvoy, 138 N. Center St., Reno.
Secretary—R. W. Shearer, 215 Sierra St., Reno.
Meetings—Twice a month, 15th and 30th.

Oregon Ass'n of Electrical Contractors and Dealers
President — A. S. Halls, 262 Stark St., Portland.
Secretary—J. Willis Oberender, 301-2 Dekum Bldg., Portland, Ore.
Meetings—Every Saturday, 1:30 p. m.—Secretary's office.

Portland Local Ass'n of Electrical Contractors and Dealers
President—Allen S. Halls, 517 Railway Exchange Bldg., Portland.
Treasurer — J. W. Oberender, 301 Dekum Bldg., Portland.
Meetings—Saturday, 3 p.m., at 301 Dekum Bldg.

Utah Society of Electrical Contractors and Dealers
President—J. V. Buckle, Buckle Electrical Co., 70 E. 1st St., Salt Lake City.
Secretary—E. H. Eardley, Eardley Bros. Co., 37 E. 1st St., Salt Lake City.
Meetings — Every Friday noon at Commercial Club.

Washington Ass'n of Electrical Contractors and Dealers
President — V. S. McKenny, NePage & McKenny Co., Armour Bldg., Seattle, Wash.
Secretary — H. D. Alleson, 404 Oriental Bldg., Seattle, Wash.
Meetings — Quarterly—second Thursdays of March, June, September and December.

JOBBERS' ASSOCIATIONS

Electrical Supply Jobbers Association
General Secretary — Franklin Overbagh, 411 So. Clinton St., Chicago, Ill.
Meetings—Semi-annual.

Pacific Coast Electrical Supply Jobbers
President—Sam H. Taylor, 84—2nd St., San Francisco.
Secretary — Albert H. Elliot, 544 Market St., San Francisco.
Meetings—Quarterly. Last meeting: Del Monte, January 24.

Electrical Credit Ass'n of the Pacific Coast
President—C. L. Gilson, Gilson Electrical Supply Co., 304—12th St., Oakland, Cal.
Secretary — Albert H. Elliot, 544 Market St., San Francisco.
Meetings—Annually: San Francisco; May.

OF ELECTRICAL INTEREST

National Electric Light Association
President—J. W. Lieb, N. Y. Edison Co., New York City.
Executive Secretary—T. C. Martin, 33 W. 39th St., New York City.
Meetings—June.

Pacific Coast Section, N. E. L. A.
President—H. F. Jackson, Holbrook Bldg., San Francisco.
Secretary—A. H. Halloran, Crossley Bldg., San Francisco.
Meetings—Annually, in April.
Next meeting — Del Monte, April 24-27, 1918.

Portland Section, N. E. L. A.
Chairman—C. L. Wernicke, care Westinghouse Elec. & Mfg. Co., Portland, Ore.
Secretary — R. J. Davidson, care Pacific Power & Light Co., Portland, Ore.

Illuminating Engineering Society
Meetings—First Tuesday each month.
President—G. H. Stickney.
Secretary—Clarence L. Law.
Western representative—Romaine Myers, Bacon Bldg., Oakland.

New Mexico Electrical Association
President—M. R. Buchanan, Silver City, N. M.
Secretary—E. M. Haggerson, Silver City, N. M.
Meetings—Annually, in February.

Southwestern Electric and Gas Association
President—H. C. Morris.
Secretary — H. S. Cooper, 403 Slaughter Bldg., Dallas, Texas.
1918 Convention—April 15th and 16th, at Galveston, Texas. Headquarters, Galvez Hotel.

Northwest Electric Light and Power Ass'n
President—Guy W. Talbot, 1212 Spalding Bldg., Portland, Ore.
Secretary—Geo. L. Myers, 1212 Spalding Bldg., Portland, Ore.
Meetings—Convention held annually. Executive Committee, governing body of Association, meets upon call of its chairman.
Next convention will convene in Portland, September 11, 1918.

Los Angeles Jovian Electrical League
President—H. N. Sessions, San Fernando Bldg., Los Angeles.
Secretary—W. C. McWhinney, Southern California Edison Co.
Meetings — Every Wednesday, 12 m., at Jahnke's Tavern, 524 S. Spring Street.
March 6—August F. Knudsen, "Hawaii."

San Francisco Electrical Development League
President—R. E. Fisher
Secretary — J. W. Redpath, Rialto Bldg., San Francisco.
Meetings—Every Wednesday, 12:10 p. m.; luncheon, Palace Hotel.

Electric Metermen's Association
President — J. E. Bridges, Westinghouse Electric & Manufacturing Company.
Secretary — A. E. Coney, Great Western Power Company.
Meetings—About every 50 days.

Alameda County Electrical Club
President—George Drew, Pacific States Electric Company, Oakland, Cal.
Secretary — George B. Furmiss, Pacific Gas & Electric Company, Oakland, Cal.
Next meeting—March 21st.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

National Officers
President—Charles T. Main, Engineering Society Bldg., New York City.
Secretary—Calvin W. Rice, Engineering Society Bldg., New York City.

San Francisco Section, A. S. M. E.
President—B. F. Raber, University of California, Berkeley.
Secretary—Chas. H. Delany, 445 Sutter St., San Francisco.
Meetings—Quarterly.
Thursday lunches have been arranged at the Engineers' Club, 57 Post St.

Los Angeles Section, A. S. M. E.
President—F. G. Pease, Mt. Wilson Solar Observatory, Pasadena, Cal.
Secretary—T. J. Royer, 200 Title Insurance Bldg., Los Angeles, Cal.
Meetings—Quarterly.

ENGINEERS' CLUBS

Oregon Society of Engineers
President — Orrin E. Stanley, Box 973, Portland, Ore.
Secretary—C. J. Hogue, Box 973, Portland, Ore.
Meetings—Annual: Feb. 4, 1918. Monthly: Third Thursday of each month.

The Engineers' Club of Seattle
President—J. F. Pinson, Seattle, Wash.
Secretary—E. J. Bartells, Northern Life Bldg., Seattle, Wash.
Meetings—Thursday noon at the club rooms at 410 Arctic Bldg. A buffet luncheon is served every day. A special welcome is extended to all engineers visiting the city.

Engineers' Club of San Francisco.
President — B. P. Legare, 58 Sutter St., San Francisco.
Secretary—J. R. Brownell, 525 Market St., San Francisco.
Annual meeting: October.
February 26—C. T. Hutchinson, "Employing Technical Men."

Idaho Society of Engineers
President — W. H. Gibson, Mountain Home, Idaho.
Secretary—Ira F. Shaffner, Boise.
Annual meeting: January.

Engineers' Club of Oakland
President—R. S. Chew, Oakland Chamber of Commerce, Oakland.

MISCELLANEOUS

American Ass'n for the Advancement of Science—Pacific Division
President—D. T. MacDougal, Director Desert Laboratory, Carnegie Institution, Tucson, Arizona.
Secretary (acting)—J. R. Douglas, 430 Library, University of California, Berkeley, Cal.
Meetings—Annual.

American Chemical Society—Oregon Section
Secretary—Norman C. Thorne.
March 2—W. P. Schuch, "The Deodorization of Fatty Oils."

Foreign Trade Club
President — W. H. Hammer, Monadnock Bldg.
Secretary — Wm. E. Hague, Monadnock Bldg.
Meetings—238 Merchants Exchange Bldg., San Francisco. Every Wednesday evening.

Pacific Coast Gas Association
President — John D. Kuster, care Pacific Gas & Electric Co., San Jose, Cal.
Secretary—Henry Bostwick, 445 Sutter St., San Francisco.
Meetings—Annual. Next convention—September, 1918, in Los Angeles.

Society for Promotion of Engineering Education
Secretary—F. L. Bishop, University of Pittsburg, Pittsburg, Pa.

HAPPENINGS IN THE INDUSTRY

Pierson, Roeding & Company Retire

The present management and ownership of Pierson, Roeding & Company are withdrawing from the selling agents field. Their several pleasant relations with the various companies whose accounts they had had and whose products they have sold with great success for many years past are about to be discontinued.

Mr. S. Herbert Lanyon has obtained the Pacific Coast representation of the Federal Signal Company account. Mr. Lanyon has been for many years past connected with Pierson, Roeding & Company as former manager of their Portland office. For the last two and one-half years, approximately, he has been sales manager of the San Francisco office.

The Locke Insulator Mfg. Co. has arranged with the Pacific States Electric Co. to sell Victor Insulators on the Pacific Coast. Mr. H. R. Noack of the Pacific States Electric Company will personally direct the sales policy in the West. As Mr. Noack was formerly president of Pierson, Roeding & Co., he is thoroughly familiar with the insulator situation on the coast.

Mr. Harry S. Whiting, president of Pierson, Roeding & Company, is San Francisco office manager of the Aluminum Company of America, and will devote his energies to the business of that company on the Coast, remaining the president of Pierson, Roeding & Company until its affairs are settled. Mr. Whiting has been with the Aluminum Company of America for fifteen years. He was for many years in their New York office; afterwards was manager of their Philadelphia office, and was manager of their Pittsburgh sales office just prior to coming to the Coast in November, 1915, when he assumed the duties of vice-president of Pierson, Roeding & Company on December 1, 1915. Since June, 1916, he has been president of Pierson, Roeding & Company.

Changes and Beginnings

Northwestern Electric Company, Pittock building, has taken out a permit to erect a $15,000 building at the foot of Lincoln street. Charles C. Moore & Co. are engineers for the company.

The deal which has been under consideration for several months between James R. Wheeler and Arthur Blanchard of Marshfield and the Gardiner Light & Power Company has been concluded and the Umpqua Power Company organized at Reedsport, Ore., and will take over the first named plant, which will be removed and light furnished to that town from the plant which will be established at Reedsport.

F. M. Lewis and others have incorporated the Water Lift & Power Company at Centralia, Wash., with a view to making and using a propeller type of current water motor, which will operate under pumping machinery to lift water to desert land. Mr. Lewis patented the motor.

Wagner Electric Company, Seattle, has moved its offices from 506 Pacific Electric building to 538 First avenue, south, where more commodious quarters have been fitted up and a new service station established. Increased business necessitated this move. Business with the shipyards has been largely increased. C. Kirk Hillman remains in charge of the offices.

The Westinghouse Electric & Manufacturing Company announces the removal of its office from Phoenix, Ariz., to Tucson, Ariz. Its representatives, Messrs. J. H. Knost and W. G. Willson, will have headquarters in the Immigration building at the latter point.

Personal Items

Captain Richard P. Henry, late of the United States Army, has joined the selling forces of the Square D Company, Detroit, manufacturers of steel enclosed safety switches, and has been appointed to the Indiana territory, with head-

quarters at Indianapolis. Captain Henry was for some time connected with the Santa Susana Syndicate, Los Angeles, in the capacity of engineer and assistant geologist, and later entered the contracting business for himself, with offices at Chicago. He finally enlisted in the Engineering Corps of the United States Army, from which he was recently given an indefinite leave of absence on account of physical disability.

Solution of Seattle Transportation Problem

Solution of the Seattle transportation problem in so far as it relates to workers going to and from their labors in the shipyards, is announced by the King County Council of Defense. The outcome is the result of negotiations between the organization and county and federal authorities, and includes the operation of steam trains along the water front and an additional ferry in the harbor to the West Waterway. It is announced that the plan for steam trains for workmen along East marginal ways, which was approved by the United States Shipbuilding board several weeks ago, has been approved by the director general of railways. This plan was suggested by the special investigating committee of the King County Council of Defense, which investigated the transportation problem of the city after it had carefully considered the matter in connection with meetings of railroad men, operators and workmen. This committee also suggested service by ferry to the West Waterway, and it is planned to have the ferry Washington withdrawn from Lake Washington, same to operate from foot of Columbia street. County commissioners and port commission have each approved this step.

The report further states that following recommendations of the special investigating committee for the immediate improvement of the street car service to the shipyard district, the Puget Sound Traction, Light & Power Company had met the suggestions and carried out the improvements. Definite charges for fares have not been fixed, but as low a rate as is feasible is suggested.

Power Rates Satisfactory

North Coast Power Company, operating at Chehalis, Wash., has filed a new schedule of rates that is satisfactory to the state public service commission. The cut in rates amounts to about 33 1-3 per cent, which became effective February 1st. The new rates are nine cents for the first 40 kilowatt hours and five cents for all over that amount. The former rate was 12 cents for the first 20 kilowatt hours.

Southern California Edison Earnings

The operating statement of the Southern California Edison Company, for the twelve months to December 31 last, shows a gross of $7,382,337, a decrease of $780,163, and net operating revenue of $4,447,694, a decrease of $357,061. The surplus was $2,893,773, an increase of $147,175. Allowing about the same interest charges as were made in 1916 and for the dividend on the preferred stock, the balance, if the depreciation allowances were the same as in 1916, was equivalent to about 12 per cent applicable to the 7 per cent common stock.

Pacific Gas & Electric's Year

The Pacific Gas & Electric Company makes this comparative report for January and the year ended January 31:

January—	1918	1917
Gross operating revenue	$1,870,133	$1,773,564
Net earnings	591,820	712,943
Surplus	158,762	282,080
Year—		
Gross operating revenue	$19,909,949	$18,626,349
Net earnnigs	6,637,566	7,721,533
Surplus	1,573,277	2,761,935

Electrical Heating in Glendale

With twelve completed heating installations, the entire heating of their office and a number of other installations ordered, the Public Service Department of the city of Glendale reports very favorably on electric heating in their territory.

The sale of heaters was not advised until they had been thoroughly tested, care being taken to place them only in desirable locations. Many more could have been sold with a less careful sales policy.

Three and five kilowatt Hotpoint Heaters of the radiant type are sold, preference being given the 5 kw. size. List prices are maintained, wiring being charged for extra. The department does not do the wiring; it is entirely handled by the local electrical dealers.

They find a consistent usage of the heaters with a considerable diversity. The peak loads are caused by a superimposition of the pumping load upon the ordinary day load so that the tendency of the heaters is entirely to improve the yearly load factor.

Call for Radio Operators

In a communication just received from the office of the Chief Signal Officer, Washington, the University of California is called upon to supply experienced radio (wireless) operators. Men accepted will be ordered in groups of five, it is stated, on detached service of highly confidential nature. Those chosen for this service will be enlisted and ordered at once to Washington. It is an unusual opportunity to start on important work of great interest without any of the customary delays in training camps, the call states. It is the intention of the signal office to draw not upon these students now getting their preliminary training in radio classes, but rather upon those who have had experience as amateurs in private stations and are already proficient radio operators.

Price of Western Coal

Radical alterations in the prices of coal at the Western coal mines are announced by Federal Fuel Administrator Albert E. Schwabacher. The table of new prices officially announced is as follows:

	Run of Mine.	Prepared Sizes.	Screenings.
Colorado bituminous coal	$2.70	$3.95	$1.70
Colorado bituminous steam coal from Trinidad district	2.80	3.70	2.10
Colorado lignite coals	2.70	3.70	1.45
Montana, Wyoming and Utah coals	3.10	3.75	1.95

Readjustment of Electricity Rates

Readjustment of electricity rates in Northern California, which will necessitate a physical valuation of the Pacific Gas & Electric and Great Western companies, will be undertaken by the State Railroad Commission, with the initial hearing on March 15. The Universal Electric & Gas Company will also be a party to the proceedings, having been included in the original San Francisco case. A vigorous protest against making industrial activity bear the full burden of the increase sought was made recently by the Bethlehem Company, when officials of the Union Iron Works came to explain that they are building millions of dollars' worth of ships for the United States Government on a cost plus profit basis.

An Irrigation School

The irrigation school held at Redmond, recently, was the first of its kind yet held. A series of lectures on irrigation practice, irrigation laws, irrigation management and engineering, as well as practical field demonstrations, were included. Field demonstrations were given in selecting and laying out land for irrigation, locating laterals by simple leveling instruments, constructing weirs, drops, measuring boxes, flumes and other structures. The entertainment and banquet given by the Redmond Commercial and Ladies' Club fittingly closed the session.

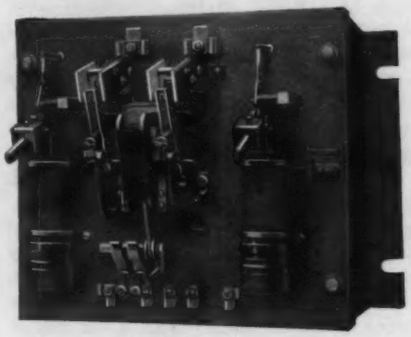
Errata: In the issue of the Journal of Electricity for February 1, 1918, the leading article dealt with the new turbine installation of the White River Plant of the Puget Sound Traction, Light & Power Company under the general title: "The Most Powerful Turbine in the World." This should have read "The Most Powerful High Head Turbine in the World," as there have been installed low head turbines of 31,000 hp. capacity.

LATEST IN EVERYTHING ELECTRICAL

(A pull socket current tap which makes it possible to avoid inserting the hand into a narrow lamp shade for the purpose of attaching a plug to the socket each time an electric appliance is used, a new type of moving picture machine for convention and show window use, and a new duplex Bryant switch and a squirrel cage motor which may be controlled from a distance, are among the recent additions to the field of electrical apparatus.—The Editor.)

Squirrel Cage Motors

The control from a remote point of the starting and stopping of single phase and standard polyphase motors, as well as high torque polyphase motors, is often desirable, if not essential. Such installations in connection with pumps for railroad water tanks, and various other pump and compression applications, coal and ash conveyor installations, etc., are at once called to mind. The control may be a float switch closing and opening the control circuit with changes in the water level of a tank; or a pressure regulator performing similar service in a closed system; or by push button stations, one button being normally open and one normally closed. In any case some form of automatic device must be used (unless the motor is very small) to handle the motor current. The automatic starting switch shown in the accompanying illustration is of the double pole clapper type and is made for a single phase and standard polyphase motors up to 15 horsepower and for high torque polyphase motors up to 50 horsepower. Besides the double pole switch, two inverse time element overload relays are mounted on the same slate panel, which is supported on a press steel frame.



Automatic starting switch

When used with float switch, pressure regulators or snap switch, the overload relays are arranged for manual reset; hence when an overload occurs the operator is required to go to the starting panel before the motor can again be started, a feature which results in more careful attention to operating conditions and lessened abuse of the motor.

When used with three wire controlling apparatus such as two push buttons, one normally open and one normally closed, the overload relays can be furnished with self-resetting featuure.

The wiring diagram (Fig. 1) shows the advantages of this feature and why depressing the start button will immediately restart the motor after a shut down from overload trip, voltage failure or intentional stopping with stop button.

A glance at the control circuit diagram shows that depressing the start button closes the circuit to the coil M through the stop button and both overload relay trip contacts. The closing of the main contactor connects the control circuit to the line at H and this holds in the main contactor independent of the start button. The reader will note, therefore, that the control circuit will be broken and the contactor opened if either of the overload relays operate, the stop push button is depressed, or the main contactor opens due to low voltage or other cause.

Except on some of the smaller sizes both poles of the main contactor are equipped with powerful magnetic blowouts. The clapper switch fingers are standard CH butt contact construction with hard drawn copper tips. By the use of shading coils these contactors possess great holding power, and a total absence of magnetic hum.

The relays used on these panels are of that type in which the length of time between the instant the overload condition arises and the instant of opening the control circuit is inversely proportional to the amount of the overload. They

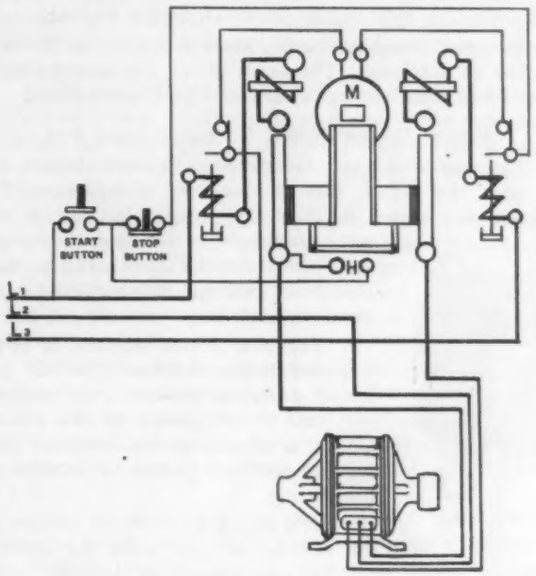


Diagram of connections

give adequate protection to polyphase induction motors against excessive continued overloads and yet permit a large initial inrush of current for starting.

The complete panel is known as the "Across-the-Line Type Self Starter" and is manufactured by the Cutler-Hammer Mfg. Co. at their works in Milwaukee, Wis.

The Attractograph

A new type of moving picture machine for office, convention and show window has been brought out by the Attractograph Company, 220 West Forty-second street, New York City. This machine displays pictures which can be readily seen in broad daylight as well as by night. Its operation is entirely automatic in all its functions. After the reel is projected it is automatically rewound and then displayed again, so that after the machine is arranged and started it will continuously operate for an indefinite period, without any further attention.

The outfit consists of two separate parts, the moving picture machine and miniature theater, in which the pictures are displayed. The moving picture machine will operate on either direct or alternating current. Two horizontal discs carry the film, which passes in one direction for projection and in the opposite direction for rewinding.

A 250 watt Mazda stereopticon lamp furnishes the light, which is automatically extinguished when the machine stops and during the process of rewinding.

The machine is equipped with two automatic safety switches, which are provided for in case the film breaks, in

which event the machine stops and the light goes out, if this occurs while projecting; in case it happens while rewinding the machine simply stops, the light being out.

All parts of the machine are made from an aluminum composition, so that the machine weighs but thirty-five pounds. The machine is very well made, all moving parts running in Norma ball bearings, packed in non-fluid oil, enclosed in dustproof housings, the machine being very substantially built and well constructed.

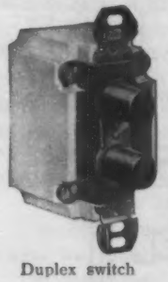
There is a dustproof and soundproof cover provided, which acts as a carrier for the machine as well as a cover.

The moving picture is placed about a foot from the theater, so that the light enters an aperture in the base; here it strikes a mirror set at an angle of 45 degrees and is reflected upwards on to a screen, set on which would be termed a stage. Another 45-degree mirror reflects an image of the screen, making the picture appear to the audience to come from a screen on the rear wall of the theater.

Standard non-inflammable films in lengths of 50 to 500 feet can be exhibited. The outfit draws 2½ amperes and is approved by the National Board of Fire Underwriters.

Bryant Duplex Switch for Single Gang Box

For controlling two independent lighting circuits from one point, the Bryant Electric Company of Bridgeport have designed and added to their line of Perkins duplex flush switches a new switch that can be used as a substitute for two separate single pole flush switches which require a two-gang switch box.



Duplex switch

The new device consists of two of the well-known Perkins Type "O" push button switches mounted in a porcelain cup, each switch having its own line and circuit terminals, so that separate feeds for the two circuits can be brought into the switch.

The switch fits into any shallow single switch box and takes the standard two-button plate; therefore the general appearance is considerably bettered by the use of the smaller plate, and the cost of material used is considerably reduced.

This switch is specially advantageous where the public service company has a two-rate schedule. As the switch has separate feeds, a circuit at each rate can be passed throuugh one box and controlled at the same point.

The new device, which is known as Type O, Duplex Gang switch, No. 2709, is National Electric Code Standard and is rated at 10 amperes, 125 voles—5 amperes, 250 volts.

A Pull Socket Current Tap

The Harvey Hubbell Company is now placing on the market a pull socket current tap. The device is of the same mechanical construction as the ordinary pull socket, to which has been added a plug receptacle built into the side of the body. It can be supplied with a ⅛-inch, ¼-inch, ⅜-inch or pendant cap.

Pull socket tap

The flow of current to the lamp base is controlled by the pull chain. The terminals of the receptacle are continuously in circuit.

The use of this socket eliminates the annoyance of a long cord running beneath the fixtures to operate the various table electrical appliances now in general use without the necessity of sacrificing the use of the light.

This device will make quick appeal to anyone who has tried to grope into a lamp shade for the purpose of attaching a plug to the socket.

ALIENS IN AMERICAN INDUSTRIES

(Industry faces a grave problem in the unfriendly employee, alien or disloyal citizen. The outline below, gotten out by the National Americanization Committee, indicates a practical method of solving this problem.—The Editor.)

First of all take a census of all employes and divide them into four classes—native born, naturalized citizens, friendly aliens, and alien enemies. If they are naturalized citizens of enemy alien descent they had better be classed industrially with alien enemies until something of their history and record is known. Let us insist frankly that a man born on another soil has to prove himself for America.

Second—Make an analysis of a map of your plant showing its vulnerable spots. Where will a fire do the greatest damage; where is waste accumulated; what hydrant is most vital in extinguishing a fire; where is the control of your lighting system; and how accessible is your surtax bond; where will an explosion cause the most damage; what machines are most vital or difficult to replace; where can goods in transit be tampered with easiest? A dozen other things have already suggested themselves to you. Now find out what kind of workmen are in charge of these vulnerable points. If they are enemy aliens, transfer them at once. Don't wait to have them prove their loyalty.

When fences are put up and windows barred and guards established, do you consult your factory plan to see that every vulnerable part is included, or do you do like one concern in New England—leave your transformer out in a field, fifty feet outside of the fence, where an enemy with a tin can of powder could paralyze your plant?

Lighting is the next important essential. Every possible improvement should be made; vulnerable points should be especially well lighted. Keep alien enemies and persons of doubtful loyalty in the light all of the time.

Keep outsiders out. Verify credentials of visitors. When they get in, see that they go only to the place they are supposed to go. Don't send them alone. Escort them in, stay with them, and escort them out.

One way to keep outsiders out is to reduce your labor turnover. Every time a new man is taken on who is not known, it increases the risk. After the registration of enemy aliens in February, ask every new employe if he has such a registration card.

Permits should be required by employes to go to different parts of the plant. A general tag is not sufficient. An alien enemy in one place may be a low risk; in another a high risk.

Appoint some employe as an aliens captain in the plant and give him a committee if it is advisable. Call him by any preferred name, but give him the whole job of looking after the safety of the plant from the man-power end.

Take a personal interest in the alien. If it is necessary, set up an information bureau to help him understand drafts and regulations and registration. If he wants to learn English and become a citizen, help him to do so. See that he gets American information on bulletin boards, in pay envelopes and otherwise, to offset the anti-American material sent him or told him. (Over 140,000 sets of civic lessons in foreign languages have already been handled by industries through pay envelopes.)

When this intelligent handling of alien enemy and those of doubtful loyalty is in operation, the plant is ready for another step—the systematic removal of every possible cause for unrest, dissatisfaction, disloyalty and disturbance. The man who strikes may think it is bad housing or treatment; the German propagandist knows it's German efficiency playing through American negligence and carelessness.

The American government cannot protect the plant that will not protect itself, and the invisible war being carried on in American industries must be won by American manufacturers or the visible war in Europe will be lost.

NEW ELECTRICAL DEVELOPMENTS

(On April 2d the proposition of buying the street railway system is to be put before the voters of Tacoma, together with a proposition for a five million dollar power plant. The tying-in of transmission lines as a method of war saving continues down the coast. Activities for the two weeks period on the whole are normal, although a policy of retrenchment is being carried out by big power interests in the Pacific Central District.—The Editor.)

THE PACIFIC NORTHWEST

LA GRANDE, WASH.—Preparations are being made by the American Nitrogen Products Company for the installation of three electric ovens at its plant.

ROSEBURG, ORE.—Pacific Telephone & Telegraph Company contemplates reconstruction of its lines along the Pacific highway in Douglas County.

POULSBO, WASH.—A franchise for transmission and electric lines was granted to the Puget Sound Pulp and Power Company for a term of twenty-five years.

CHEHALIS, WASH.—City commission has decided to submit to vote on April 20 the question of granting a power and light franchise to O. E. Anderson of Portland.

WALLA WALLA, WASH.—L. A. McArthur, speaking for the Pacific Power & Light Company, announces that the local light service is to be greatly improved in the near future.

SEATTLE, WASH.—Puget Sound Traction, Light & Power Company has permit to erect coal bunkers at 1316 Western avenue, to cost $17,000. Stone & Webster, 868 Stewart street, builders.

POMEROY, WASH.—The city council is considering an application of the Pacific Power & Light Company for a franchise to supply electricity for lamps and motors in Pomeroy for a period of fifty years.

SPOKANE, WASH.—Contract, it is understood, has been awarded by the Washington Water Power Company for a third generator (22,500 horsepower) for its Long Lake plant to the General Electric Company.

BELLINGHAM, WASH.—The Puget Sound Traction, Light & Power Company is contemplating the erection of an electric transmission line to the Cokedale mine to furnish 500 horsepower to the plant there.

EPHRATA, WASH.—The Intermountain Power Company has petitioned the commissioners of Grant County for a franchise to construct and operate an electric transmission line over certain highways in Grant County.

SEATTLE, WASH.—Finance committee of the city council recommends the expenditure of about $6000 to secure information with reference to the Ruby canyon power site, where the city proposes to erect a large plant.

FERNDALE, WASH.—The British Electric Company, it is reported, is considering extending its electricity here for lamps and motors. The company also proposes to furnish electrical service to farmers in the Glendale district.

STEILACOOM, WASH.—The installation of a municipal water works system is under consideration in connection with lighting plant. A 12½ horsepower electrically operated pump has been purchased for same. R. F. Gleason is electrician.

TACOMA, WASH.—Plans are under way for the city to furnish its own electricity to operate the municipal car line across the tide flats. Plans are being made by the city electrical department for construction of a substation on the tide flats line.

TACOMA, WASH.—An ordinance is being prepared under the direction of H. F. Gronen, commissioner of the light and water department, which will be submitted to the voters at the election to be held on April 2, asking their opinion on the purchase of a $5,000,000 power plant for the city of Tacoma.

MARSHFIELD, ORE.—Arrangements are being made by the C. A. Smith Lumber Company to install additional electric equipment to double the output of its mill. Machinery costing about $80,000 for the second unit, it is reported, has been ordered.

CHEHALIS, WASH.—Central Light & Power Manufacturing Company has filed a petition with Lewis County commissioners for franchise to construct and operate electric light and power line between Walville and Meskill, a distance of twelve miles.

SPOKANE, WASH.—On a bid of $40,545, the Washington Water Power Company was awarded the contract for installing the new ornamental curb lighting system on Post street from the end of Post street bridge to the north side of Third avenue.

SEATTLE, WASH.—City building department will erect the proposed power substation for the city lighting department at Fourteenth avenue N. W. and Forty-ninth street by day labor. Construction will be supervised by City Architect Daniel Huntington. The building is to be of reinforced concrete.

SEATTLE, WASH.—Purchasing agent of the Alaskan Engineering Commission, room 422, Bell street dock, will receive bids up to March 25th for furnishing the commission with electrical supplies, including 6600 feet of conduit, 40,000 insulators, 25,000 feet 5-16-inch cable and about 100,000 feet of wire.

COLVILLE, WASH.—A contract has been closed between the Washington Water Power Company of Spokane and the Stevens County Light & Power Company of Colville, whereby an electric transmission line, forty miles long, will be erected to furnish electricity in the southern part of Stevens County.

EVERETT, WASH.—The United Steel Company, which contemplates erection of a steel rolling mill here of 60 to 100 tons capacity, using two reheating and one electric furnace, has procured a site and established local offices. J. Johnson, general superintendent, has left for the East to procure machinery and equipment.

SEATTLE, WASH.—City Engineer A. H. Dimock has submitted plans for the proposed elevated railway to the shipyards and the board of public works has taken the plans under consideration. The road is to be a timbered elevated roadway to extend from First avenue South and Washington street to West Spokane street, estimated cost about $350,000.

SEATTLE, WASH.—Puget Sound Traction, Light & Power Company has made application to the city council for a franchise for the operation of a street railway along Avalon way and Thirty-sixth avenue Southwest to the intersection of the latter street and West Snoqualmie street. With the request the company submitted a proposed franchise ordinance which provides for the completion of the line within twelve months of the granting of the franchise.

TACOMA, WASH.—By the unanimous consent of the city council, City Attorney U. E. Harmon was authorized to proceed with the drafting of two ordinances placing before the voters at the spring elections two propositions for the purchase of the Tacoma Railway & Power Company street car system and the acquisition of either a contemplated power plant or a site upon which the city may ultimately build

a plant. The two propositions will call for the expenditure in municipal utility bonds of approximately $10,000,000. On April 2 the proposition of buying the street railway system will be put on the ballot, and two weeks later the voters will be asked to vote on the acquisition of a new auxiliary power plant.

PACIFIC CENTRAL DISTRICT

VALLEJO, CAL.—The Great Western Power Company is running its power line to the Cereda pumping station.

SACRAMENTO, CAL.—The Pacific Gas & Electric Company plans to extend its transmission lines to Guinda, Rumsey and Brooks.

OAKLAND, CAL.—The Pacific Telegraph and Telephone Company has let the contract for the erection of a six-story class A building at 150 North Fifteenth street.

OAKLAND, CAL.—The San Francisco-Oakland Terminal Railway Company is considering the construction of a railway line on Adeline street, from First to Sixteenth.

FRESNO, CAL.—The city trustees granted the petition of property owners to install electroliers on both sides of Van Ness avenue. In the bids the call will be for alternate tenders on cast iron and concrete electroliers.

OROVILLE, CAL.—Deeds placed on record gave the information of the acquisition by the Great Western Power Company of 320 acres on the south bank of the Feather river east of Oroville.

PITTSBURG, CAL.—The Pacific Gas & Electric Company has submitted a proposal to the city trustees for installing an electric service for the southwest addition. The cost is estimated at about $2000.

SAN FRANCISCO, CAL.—The board of public works has awarded the contract for the "D" line extension on Greenwich street of the Municipal Railway system to Eaton & Smith, for the lump sum of $28,600.

MONTEREY CREEK, CAL.—The Pacific Gas & Electric Company has shut down on its seven-mile tunnel in the Big Bend. Only two caretakers are on the payroll, one at the cove and the other at the intake end of the long bore.

FRESNO, CAL.—The San Joaquin Light & Power Corporation and the Mount Whitney system tied their power transmission lines together at Strathmore in order better to stand the strain of unusual service in a dry year. It is planned to interchange power whenever necessary.

HANFORD, CAL.—Alpaugh is planning on a lighting system for the town site. The community, not being an incorporated city, will have to be organized on the state law providing for the formation of a lighting district. A petition will be circulated at once calling for an election on the question.

SAN FRANCISCO, CAL.—The United Railroads filed with the board of supervisors a demand on the city for $288,500 damages it says it has suffered through the blanketing of its lower Market street lines by the Municipal Railway and by interference with its service caused by excavations made when the Municipal Railway tracks were installed.

SACRAMENTO, CAL.—J. B. Thompson of Vina, Tehama County, has applied for 100,000 acre feet of waters of Butte creek, in Butte County, for the irrigation of lands in Townships 20, 21 and 22. The same applicant also filed application for 30,000 acre feet of Inconstance and Mountain House creeks, in Siskiyou County, for irrigation on 4000 acres.

SACRAMENTO, CAL.—One-man, pay-as-you-enter front entrance street cars were placed in operation here on one of the local lines operated by the Pacific Gas & Electric Company. The operator, who also acts as conductor, "flags" railroad crossings by stopping thirty feet from the tracks and looking both to his right and left before approaching nearer.

REDDING, CAL.—The Northern California Power Company has informed the city trustees that for legal reasons connected with the terms of its bond issue it cannot set a price on its lighting system for sale to the city. The only way the city can acquire the system, the company states, is by condemnation proceedings. The city trustees adopted the ordinance calling for an election for "acquiring or building" a system of electric lights for the city.

OAKDALE, CAL.—The Sierra & San Francisco Power Company is preparing to enlarge its storage capacity in the mountains, as a result of an agreement signed with the Oakdale and South San Joaquin irrigation districts. H. F. Jacobson, president of the company, announces that plans are now under preparation for the construction of a third reservoir on the south fork of the Stanislaus river, which will provide 18,000 acre feet more of storage. This will increase their storage capacity in the mountains by 50 per cent.

BAKERSFIELD, CAL.—A new power plant to increase its present output by 20,000 horsepower is to be built at the mouth of Kern River canyon by the San Joaquin Light & Power Company. An application for 250 second-feet of water in addition to that already in use by the company from Kern river at that point has been filed with the state water commission. This will just double the energy now being used on the smaller plant of the company situated there. The plan is to dismantle the old plant after the new one is completed. The plant is to cost $1,500,000.

THE PACIFIC SOUTHWEST

SANTA FE, N. M.—The village trustees of Des Moines have decided to vote on a $50,000 bond issue to purchase and extend the water and light service.

PASADENA, CAL.—The city purchasing agent has been authorized to purchase, without advertising, lamps, fuel oil and meters for the light department.

WILMINGTON, CAL.—The Chamber of Commerce has launched a movement to call for an election to vote $150,000 bonds to put water and gas mains in every street in the city.

LAS VEGAS, N. M.—W. S. Townsend, local manager of the Las Vegas Light & Power Company, promises that much needed repairing and overhauling will be done within the next few months.

AZUSA, CAL.—Preparations are being made to increase the output of the substation of the municipal electric lighting system to 600 kva., at a cost of about $4000. Norman E. Humphrey is superintendent.

SANTA BARBARA, CAL.—The city council has received a petition for ornamental lights on Chapa street from Gutierrez to the boulevard. The city engineer has been instructed to prepare plans and specifications for the work.

YUCAIPA, CAL.—A survey has been made for the proposed Pacific Electric line from Redlands to Yucaipa City. As to when building operations are to commence both the railroad and land company officials are non-communicative.

LOS ANGELES, CAL.—A resolution was adopted by the city council ordering the installation of necessary marbelite lighting posts and appliances and the supplying of electric current for the lighting of Fifty-fifth street, between Budlong avenue and Normandie avenue.

SKULL VALLEY, ARIZ.—Negotiations with the Mountain States Telephone Company have been started by local farmers and stock growers, who have organized the Skull Valley Producers' Association. It is hoped that a telephone system will be completed here before this year's produce is ready for market.

DEL MAR, CAL.—The State Railroad Commission has authorized the sale of the electric distributing system of the Del Mar Water, Light & Power Company to the San Diego (Cal.) Consolidated Gas & Electric Company, for a consideration of $11,055. The water system of the company is not included in the sale.

WILLIAMS, ARIZ.—Another unit is needed at the municipal light plant in order to make the best use of the machinery and not injure the engine by running it at a time when it might better be stopped for cleaning or adjustment.

The council hopes to be able to add this unit soon. It will probably be a 100 horsepower engine.

SAN DIEGO, CAL.—The Railroad Commission has granted the San Diego Consolidated Gas & Electric Company permission to distribute and sell electricity under a franchise granted by San Diego County, provided it does not operate in the territory now served by the Del Mar Light & Power Company or the Escondido Mutual Water Company.

LOS ANGELES, CAL.—The problem of raising more money for the installation of an ornamental lighting system on Broadway has been shifted to a finance committee of the city council. The lowest bid for the contract is approximately $65,000, while only $60,000 has been raised for the work. Unless a contract is let at once bids may be withdrawn, as the cost of materials is increasing.

LOS ANGELES, CAL.—The public service commission has authorized leasing from the harbor commission of a tract of land on the east side of the harbor boulevard, to be used as a site for a substation for the municipal power system. The purpose is to provide a substation from which power service can be given the industries around the west basin and to pier No. 1, and across the channel in the Wilmington district.

SAFFORD, ARIZ.—The local office of the Mountain States Telegraph & Telephone Company has received shipments of material that will be used in reconstruction of an outside plant of the company's new system. A telephone line will be built to Solomonville. Thatcher and Solomonville will be served from the Safford exchange. A new switchboard, double the capacity of the present board, will be installed in the local exchange. New poles will be put in and new cables strung.

GALLUP, N. M.—The Gallup town board has taken initial steps toward holding an election to decide on whether or not the people want municipal ownership of the electric light plant. The board intends to vote on municipal ownership quotation and vote bonds at the same time. A petition asking the council to begin formalities required to install lighting and power plant was presented and an engineer will be employed by the city to estimate the cost of the plant and furnish necessary data.

LOS ANGELES, CAL.—George L. Lamy has applied for 50 cubic feet per second of Lake Elsinore, tributary to the San Jacinto river, in Riverside County, for power purposes. The proposed works contemplate an open cut and cement pipe with concrete headgate in the lake and a canal and pipe line thirty-five miles in length. By a drop of 800 feet it is proposed to develop 3300 theoretical horsepower. The amount of water to be stored is 130,000 acre feet and the estimated cost of the project is placed at $300,000.

PARKER, ARIZ.—The government has appropriated $50,000 for making surveys and estimates of the cost of constructing a complete irrigating system for tillable lands in the Colorado river Indian reservation. Appropriation of $20,000 is made for drilling wells on the Papago reservation; $50,000 has been set aside for the construction of the main canal leading from the diversion dam on the Gila river; a like amount was added to the appropriation for the dam and bridge across the river at Sacaton, and $20,000 for new work on the Ganade project in Apache County.

PHOENIX, ARIZ.—Plans are being made for the lease of about half a township on the northern edge of the Pina Indian reservation south of Chandler. The tract is to be reclaimed with wells, from which pumping will be by electricity. Farther to the westward another 10,000-acre tract has been leased by Lincoln Fowler of Phoenix. The tract will be irrigated by discharge from the Tempe-Kyrene drainage canal. In addition to these tracts the agricultural area of the reservation will have expansion by 40,000 acres through two dams to be built across the Gila by the Interior Department at $250,000 cost.

THE INTER-MOUNTAIN DISTRICT

DUBOIS, IDAHO—The Dubois Light & Power Company has filed articles of incorporation for $25,000 and selected a site for building a power plant.

SALT LAKE CITY, UTAH—The city recorder has been instructed to advertise for bids for the installation of a special street lighting system on Regent street.

WORLAND, WYO.—The Worland Light & Power Company expects to install a 125 horsepower boiler and also to purchase various instruments for a switchboard. J. M. Atkinson is manager.

CHESTER, MONT.—Steps have been taken by local citizens to secure a better lighting system in Chester. It is proposed to have the Montana Power Company extend its service to the town.

COLORADO SPRINGS, COLO.—The Golden Cycle Company is considering the construction of an electric power plant. At present the company secures electricity from the Colorado Springs Light, Heat & Power Company under a contract which does not expire until 1920.

NAMPA, IDAHO—A committee has been appointed to investigate the proposed new electric lighting contract. The old contract of $30 per month for arc lights was secured some time ago and the contract will soon expire, and the light company now wants $66 for the same service.

CALDWELL, IDAHO—Superintendent of Streets D. D. Campbell stated to the council that the Pioneer irrigation district had agreed to pay half the cost of a concrete bridge across Speedway avenue, if the city will pay the other half, in accordance with plans to be approved by the city engineer.

DUBOIS, IDAHO—The Dubois Light & Power Company, recently incorporated with a capital stock of $25,000, is planning to construct an electric plant to furnish electrical service in Dubois. A power site has been purchased on Beaver creek near Dubois, where a dam 46 feet wide at the top and 26 feet high will be built.

DENVER, COLO.—The Queen City Foundry Company of Denver has placed an order for a one-ton Booth-Hall electric steel furnace to replace the converter equipment now in use. The furnace has a holding capacity of three-quarters to one ton, and is rated at 300 kva. Energy will be delivered to the furnace by the Denver Gas & Electric Company.

PROVO, UTAH—Application has been filed with George F. McGonagle, state engineer, by Scott P. Stewart of Provo for permission to take from the north and south branches of North Fork creek 10 second-feet of water. The plans provide for the construction of a cement dam and a 21-inch iron or wood stave pipe to carry the water to a point where power will be generated by a Pelton water wheel, operated under a 1400-foot head of water. Electricity generated at the proposed plant will be distributed in Utah and Wasatch counties.

TWIN FALLS, IDAHO—At a meeting of about 100 citizens of Twin Falls, Buhl and Filer, convened to discuss ways and means of securing a mutually owned electric power and light plant and distributing system to serve this district, resolutions were adopted endorsing the principle of the public ownership of power plants. The resolution adopted further declared in favor of taking over the partially developed power site at Clear Lake.

MONA COUNTY, NEV.—Plans for a $50,000 power development, to be installed on the east side of the Sierras, were revealed to the State Water Commission in the application of A. M. Wishart, Alexander Cameron and Jabes Herrin to secure the necessary water rights. These three residents of Yerington, Nev., ask permission to impound 20 second-feet of the waters of Sweetwater creek, in Mono County. They propose to build a dam 10 feet high and 48 feet long and running from the pool so formed is to be a metallic flume three and a half miles long. There is a fall of 1132 feet and this, it is estimated, will develop 2575 horsepower.

Ad-itorial Comment

(Advertising is as important a factor in the distribution of goods as is transportation. Advertising helps to create the demand, the salesman closes the sale and the railroad delivers the goods. Without the creation of the demand the distribution would be extremely limited. Advertising is thus a strong constructive force in the selling field.—The Aditor.)

Pacific States Electric Co. tells of its ability to meet demands for all kinds of overhead line construction material.

Standard Underground Cable Co. advocates Standard cable accessories as the best means for protecting electric cable systems.

Baker-Joslyn Co. calls attention to the strength of the single interwoven wall of Duraduct flexible tubing for use in electrical construction.

Crocker-Wheeler Co. demonstrates that freedom from need for repairs justifies the slightly higher initial cost of Crocker-Wheeler motors.

Pierson, Roeding & Co. announces their retirement from business and the use of the present organization by the Aluminum Company of America.

Crouse-Hinds Co. illustrates actual installations where Z Y Condulet small motor switches are protecting motor-driven tools for machine shop and other uses.

V. V. Fittings Co. advertises vapor-proof fittings and safety devices for all classes of marine electrical installations or other places exposed to severe weather conditions.

Hubbard & Company shows an actual installation of Peirce spreader brackets and forged steel insulator pins strengthening line construction by eliminating weak points.

Moloney Electric Co., notwithstanding a 500 per cent increase in production during the past 18 months, announces that it is still able to make the best transformer deliveries obtainable.

Wells-Morris Mfg. Co. is making at San Francisco a new starting switch for motors of 5 hp. and less, 125-250 volts. This switch has the approval of accident commissions and the underwriters.

The Habirshaw Electric Cable Co. emphasizes its educational advertising work among building owners regarding the confidence that is to be reposed in architects, electrical engineers and contractors.

Allis-Chalmers Mfg. Co. devotes two pages to arguments for hydro-electric installations as conservers of fuel, suggesting further installations as advisable. Typical installations are handsomely illustrated.

The American Conduit Mfg. Co. urges contractors to read "The Wiremold Selling Plan," a book telling how people are being educated in the use of Wiremold in making convenient electrical extensions in home, factory and office.

General Electric Co. explains how the addition of sphere gaps has increased the speed of discharge of electrolytic arresters and thus affords better protection from lightning; also how G. E. synchronous condensers increase the capacity of existing systems by improving the power factor.

Landers, Frary & Clark presents the new cut-out which will stimulate the sales of Universal electric irons this spring.

The Electric Storage Battery Co. suggests the advantages of electric industrial trucks equipped with the "Ironclad-Exide" battery.

Century Electric Co. features the ring oiling bearings with which Century motors are equipped as another reason for their serviceability.

National Carbon Co. lays emphasis on the care with which Pyramid Brushes are designed to meet the most exacting conditions of operation.

The Youngstown Sheet & Tube Co. tells of the satisfaction that comes from the use of Buckeye rigid conduit and Realflex flexible armored conductor.

Sprague Electric Works sets forth several styles of conduit boxes and fittings with a suggestion that those interested secure the Sprague Conduit Bulletin for details.

Western Electric Co. suggests that Western Electric fans and sales helps are the best insurance against a poor fan season. Dealer co-operation is strongly suggested.

The Square D Co. presents a striking illustration of the protection that can be accorded even the most careless workman by the use of Square D steel enclosed switches.

The Robbins & Myers Co. gives emphasis to the satisfaction which the user gets from Robbins & Myers fans, whose beauty of design is given prominence in the advertisement in this issue.

Garland-Affolter Engineering Co. suggests special features in which Howell polyphase motors excel for severe service. Announcement is also made of conveniently situated stocks of Peerless fans.

Edison Storage Battery Supply Co. shows how Edison storage battery trucks and tractors are releasing man-power and giving the highest service efficiency for all sorts of industrial establishments.

L. Plaut & Co. reproduces one of the advertisements whereby it is popularizing the Four-in-One Light and thus facilitating sales by the electrical dealer. A country-wide list of distributors is also given.

Locke Insulator Mfg. Co. announces that the Pacific States Electric Co. have been appointed its Pacific Coast representatives coincident with the withdrawal of Pierson, Roeding & Co. from the selling agents' field.

Westinghouse Electric & Mfg. Co. advises conservation of copper for feeder circuits by installing Westinghouse feeder voltage regulators. Attention is also called to a new 14,000 kva., 150,000 volt transformer, the largest single phase transformer ever built, as an example of the company's facilities for taking care of customers' needs.